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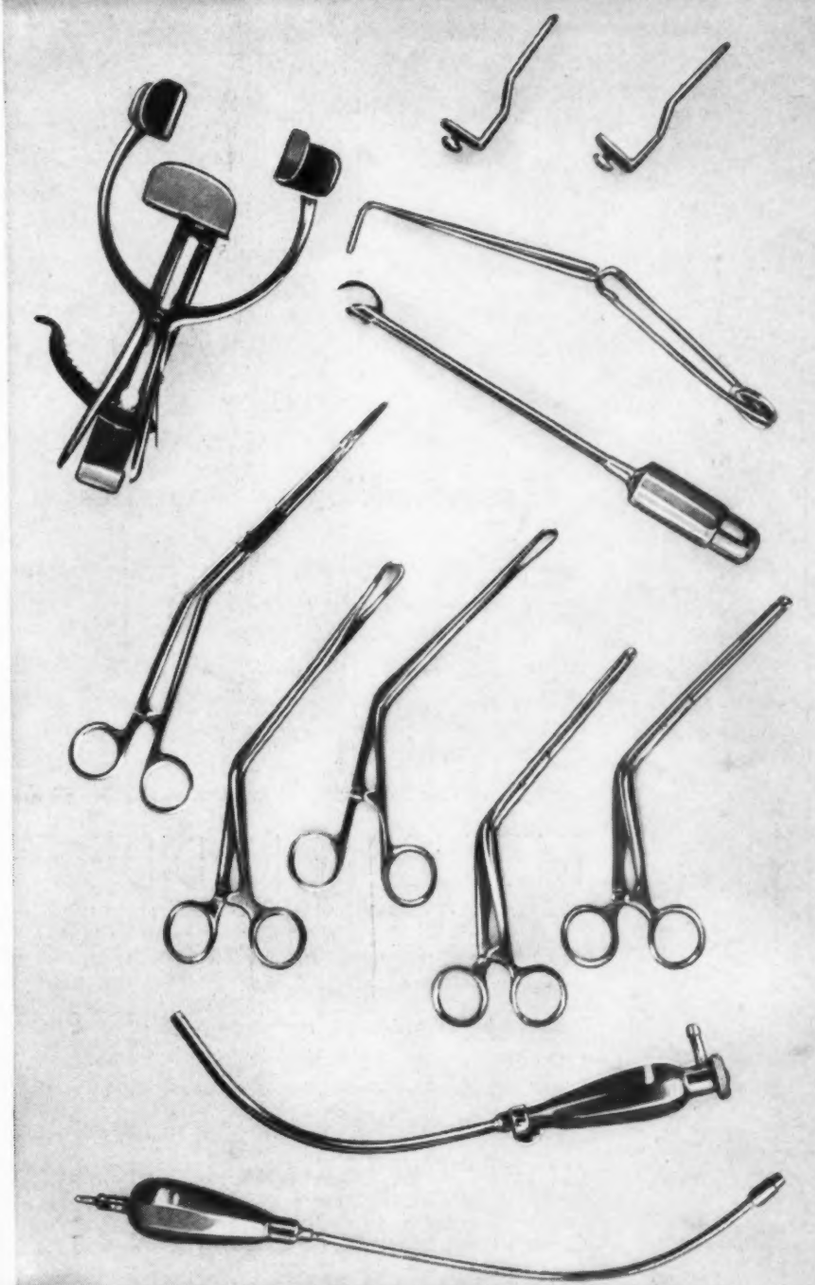

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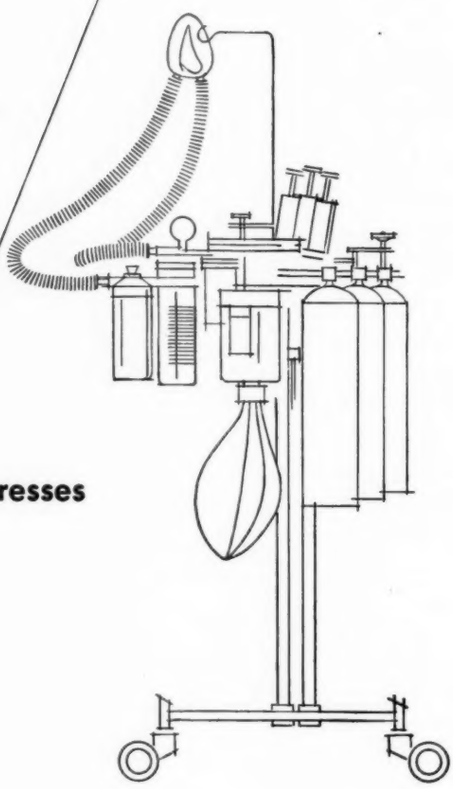

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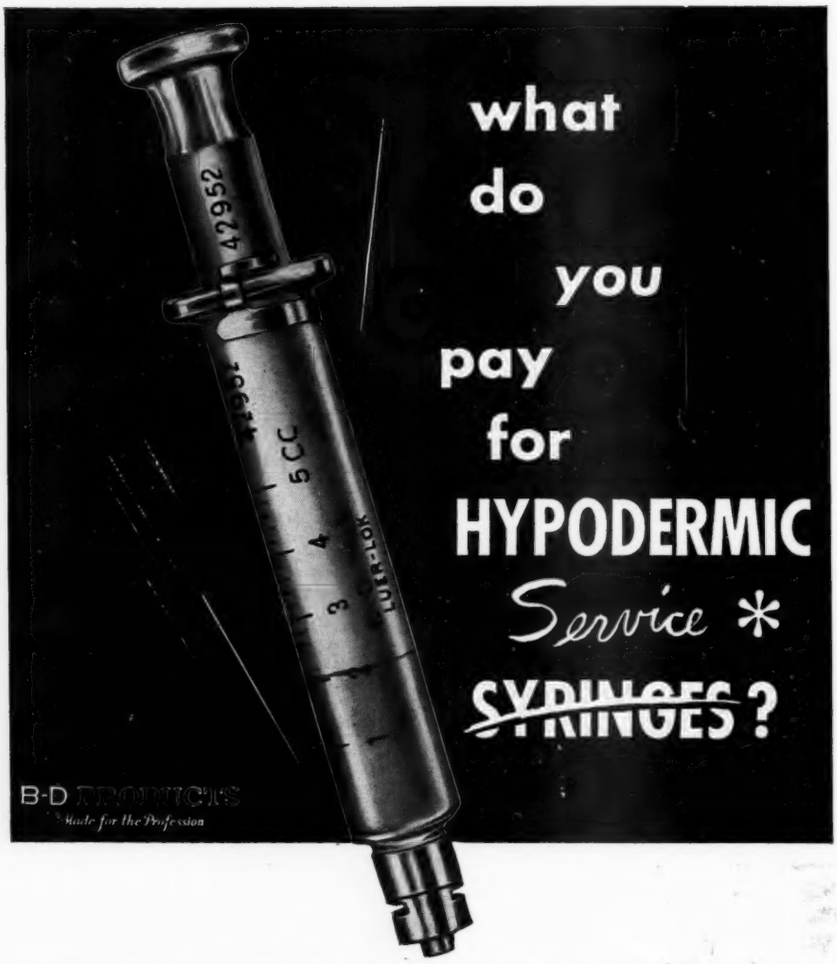

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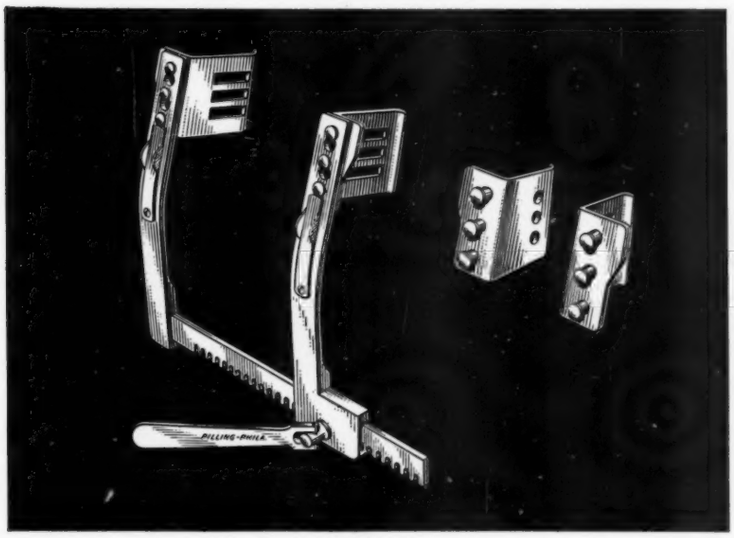

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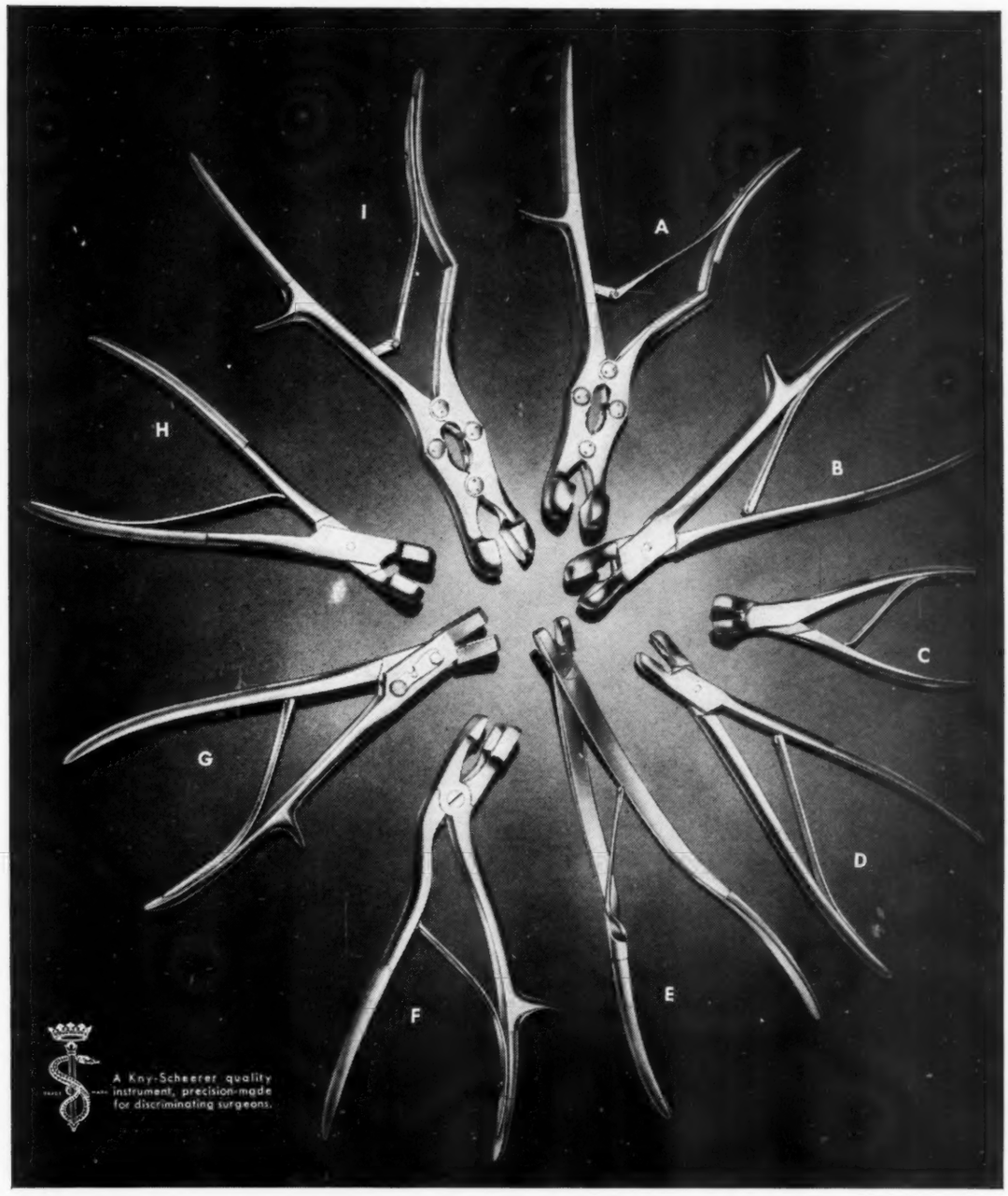

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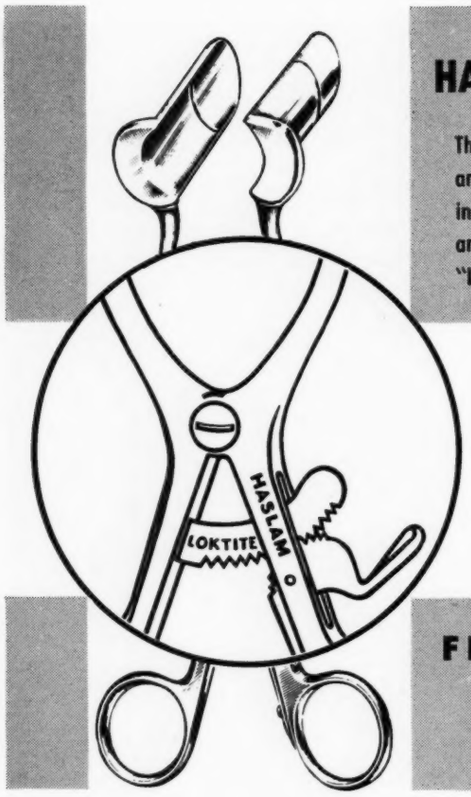

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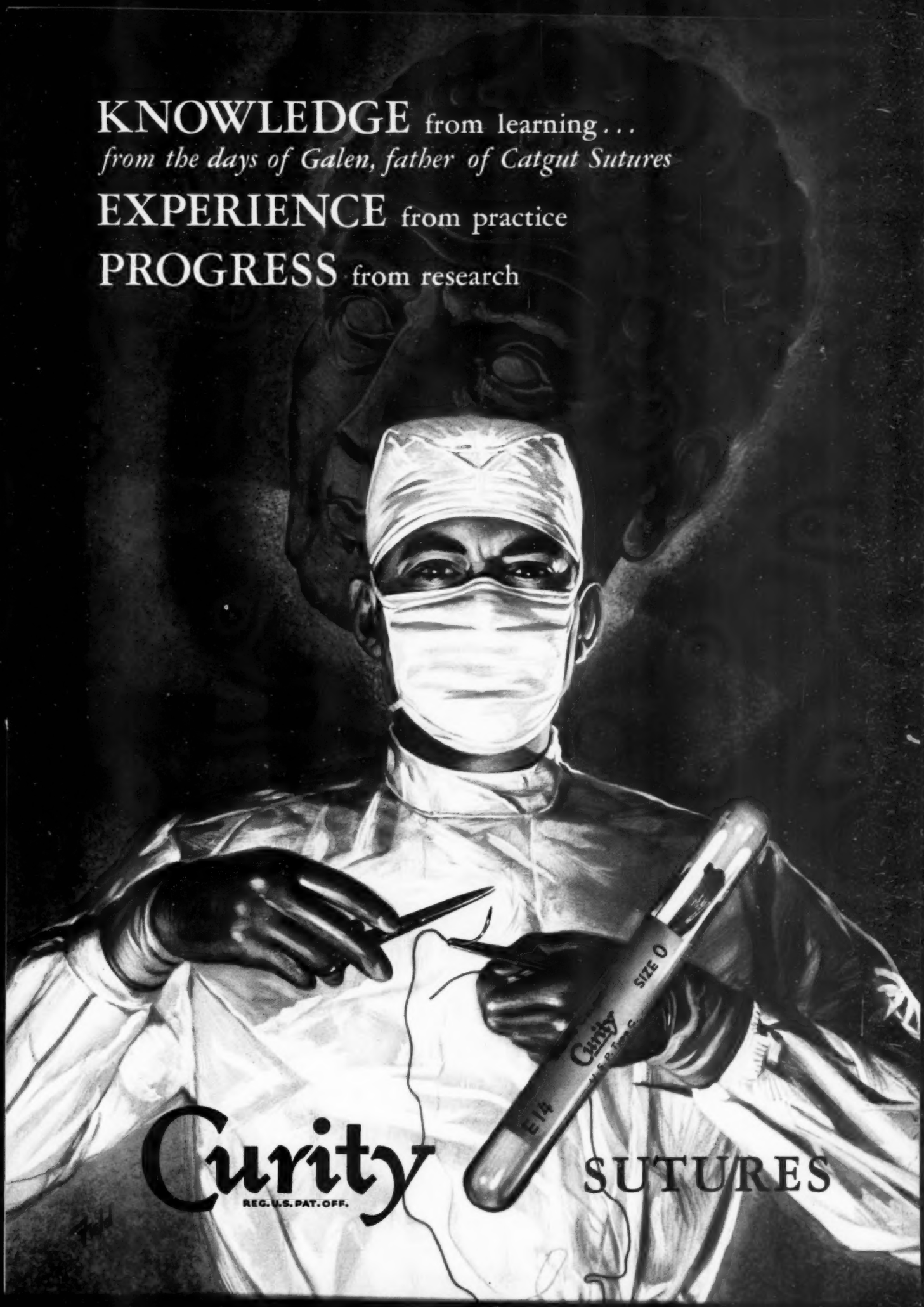
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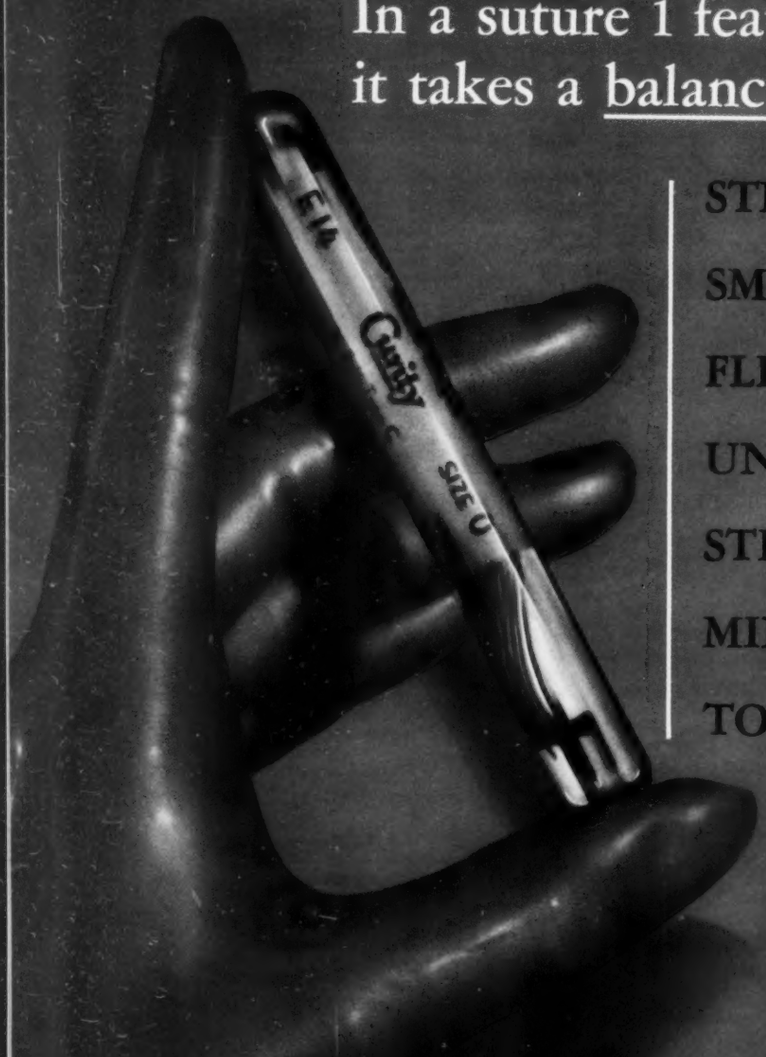

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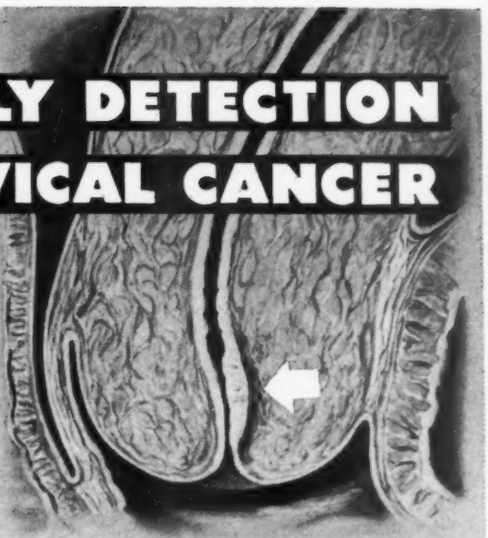

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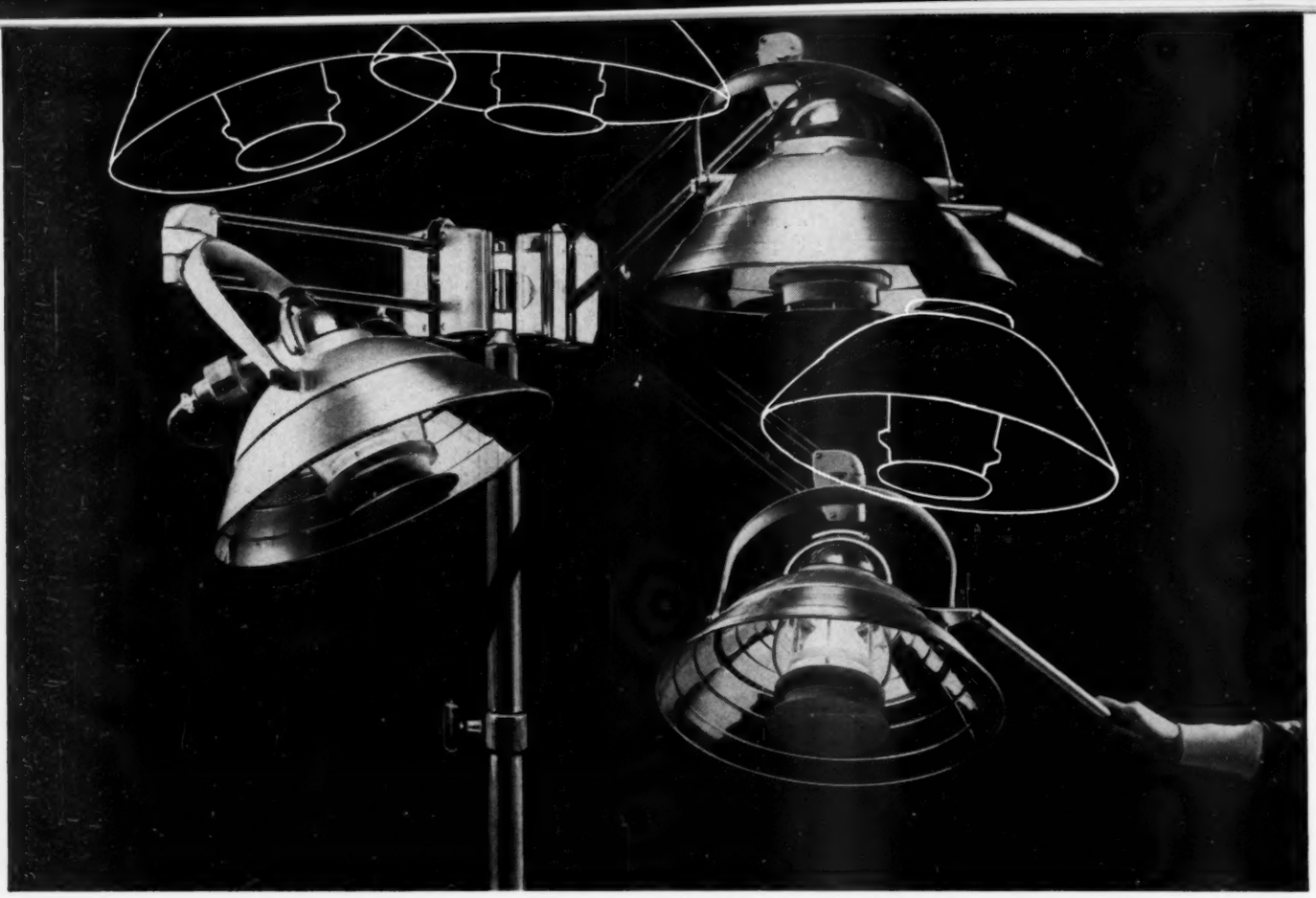

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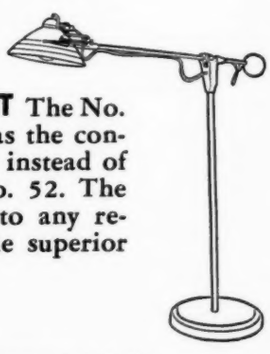

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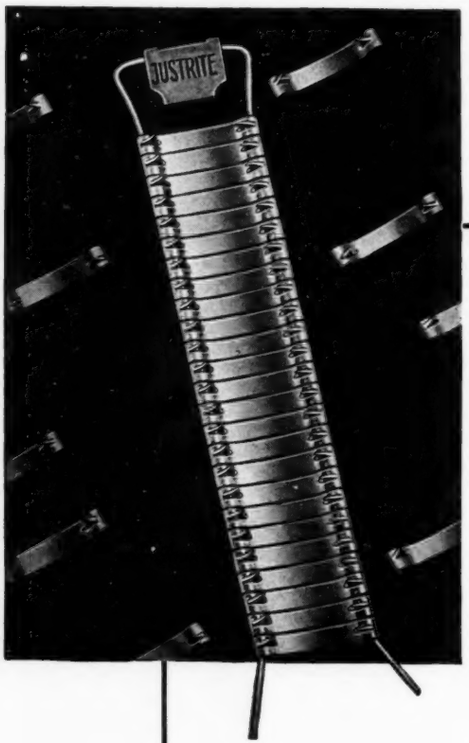

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JUSTRITE Angle of Points — They gently proximate the edges of the wound without undue contraction or pressure.

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FOR 1950

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THE AMERICAN JOURNAL OF SURGERY has instituted a new department on Streamlined Articles to allow for earlier publication and to save you reading time in an effort to keep you abreast of present day surgery. This is in no sense an abstract or rewrite. The articles are streamlined by the original author who has all the facts and is in a better position to evaluate them than some outsider. This will save you time and will bring you new facts as they are reported.

Outside the Ivory Tower

WITH more than seven million ordinary life insurance policies applied for in this country last year, 96 out of 100 were on persons acceptable for insurance, the Institute of Life Insurance reports. Of the policies issued 93 per cent were standard rate and 7 per cent extra rate policies for persons found to have some medical, occupational or other impairment. Just under 4 per cent of the applications for insurance were declined by the companies and the 275,000 declined amounted to $850,000,000 out of a total of $19,000,000,000 applied for. Chief cause for the declinations was cardiovascular-renal diseases which now constitute America's No. 1 Killer. These diseases accounted for between 40 per cent and 50 per cent of the declinations or somewhat over 100,000 cases. Medical history of past impairments was the next in importance, accounting for somewhat less than 20 per cent of declinations. Physical findings other than cardiovascular-renal caused about 15 per cent of the declinations; underweight and overweight combined less than 2 per cent; occupational hazards less than 2 per cent.

THE government of New York State should spend annually nearly 25 per cent more for hospital care than the present yearly budget of $87,000,000 according to Dr. Eli Ginzberg, director of a fifteen-month hospital study just completed for the state under a contract with Columbia University. Dr. Ginzberg is a member of the faculty of Columbia's Graduate School of Business. Although annual expenditures for hospital care in the State have reached nearly $400,000,000 annually, Dr. Ginzberg and his associates in the study declared that the state government should increase its annual expenditures in the hospital field by $23,000,000. At the same time it was pointed out in the report on the study that New York State, with only 10 per cent of the national population, is spending about 16.5 per cent of the national total for hospital care which amounts to $2,400,000,000 annually.

"The Surgical Treatment of Facial Injuries" by Varaztad Hovhannes Kazanjian, M.D. and John Marquis Converse, M.D. is a gem of the first water. Any surgeon doing rehabilitation or facial surgery should own and carefully read this work. It is based on years of experience in the treatment of many thousands of cases of facial injuries. Inasmuch as the purpose of the book is to stress the authors' viewpoint with respect to the surgical treatment of facial injuries the text is therefore limited to patients they have treated personally. It is a beautiful book of 574 pages, 746 figures, an index and a bibliography. $10.00.

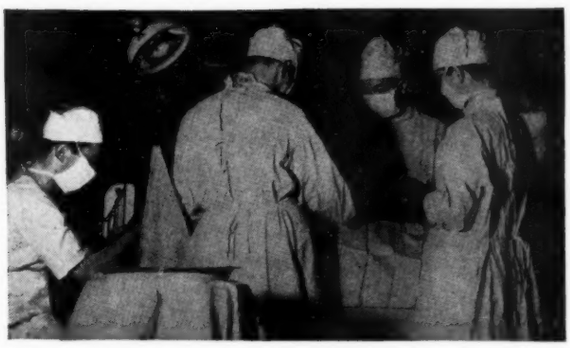
We have the third edition of "Injuries of the Brain and Spinal Cord and Their Coverings—Neuro-Psychiatric, Surgical and Medico-Legal Aspects" edited by Samuel Brock, New York University. There are twenty-eight contributors. The book consists of 783 pages, an index, bibliography and is illustrated. You'll want this book if you are interested in the subject. $10.00.

WHILE deaths from all causes among ordinary life insurance policyholders occurred at a new low rate in 1948, heart deaths accounted for more than half of the total, the Institute of Life Insurance reports. The heart disease death rate rose last year to a record high. Total deaths per 100,000 were 625.1 in 1948, compared with 668.8 in 1946 and 751.2 in 1944. Deaths from the chief cardiovascular-renal diseases, commonly called heart disease, were 327.9 per 100,000 in 1948, 325.4 in 1946 and 324.1 in 1944. These include diseases of the heart, cerebral hemorrhage and nephritis and together represented 52 per cent of total deaths in 1948. Cancer, second major cause of death, accounted for 98.7 deaths per 100,000 last year, compared with 98.0 in 1946 and 92.7 in 1944. Accidents had a death rate of 42.7 in 1948, 48.4 in 1946 and 52.4 in 1944. This improvement was shown even though motor vehicle accidents rose from 13.5 in 1944 to 18.2 in 1948. Tuberculosis deaths declined to a record low rate of 11.4 per 100,000 in 1948, one-third less than in 1944.

(continued on page 36)

Announcing...

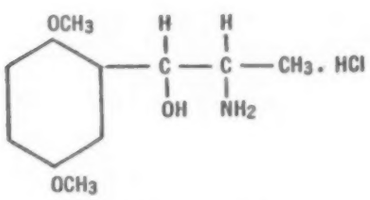
'VASOXYL' BRAND



METHOXAMINE HYDROCHLORIDE INJECTION

a NEW superior pressor agent for safely maintaining or restoring blood pressure levels during spinal anesthesia and surgical procedures

Discovered at The Wellcome Research Laboratories



EFFECTS: During operations under spinal anesthesia 'Vasoxyl' has been found by Dripps,[4] by Kistler and Ruben[5] and other investigators to be a superior drug for maintaining blood pressure.

During cyclopropane anesthesia Stutzman et al.[2] find 'Vasoxyl' a "safe pressor agent."

Intramuscular injection of 15 mg. 'Vasoxyl' produces a prompt and prolonged rise in blood pressure, *without central stimulation and without causing cardiac irregularities even during cyclopropane anesthesia.*

PACKAGING: 'Vasoxyl' brand Methoxamine Hydrochloride Injection 20 mg. in 1 cc., boxes of 12 and 100 ampuls.

BIBLIOGRAPHY:
1. *Baltzly, R., and Buck, J. S.: J. Am. Chem. Soc. 64:3040, 1942.*
2. *Stutzman, J.: J. Pharm. & Exptl. Ther. 97:385, Dec., 1949.*
3. *Hjort, A. M.; Randall, L. O., and de Beer, E. J.: J. Pharm. & Exptl. Ther. 92:283, 1948; de Beer, E. J., and Dews, P. B.: To be published.*
4. *King, B. D., and Dripps, R. D.: To be published.*
5. *Kistler and Ruben: To be published.*

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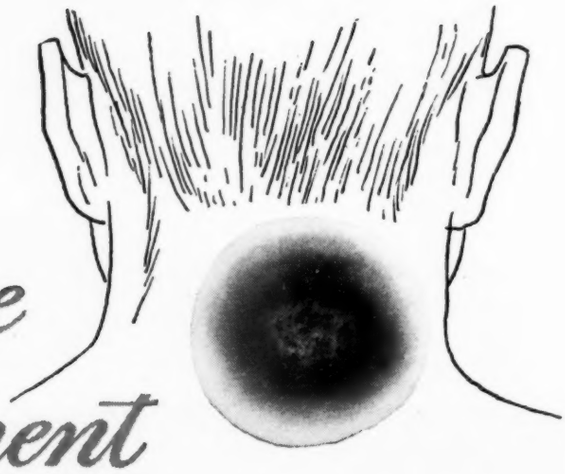

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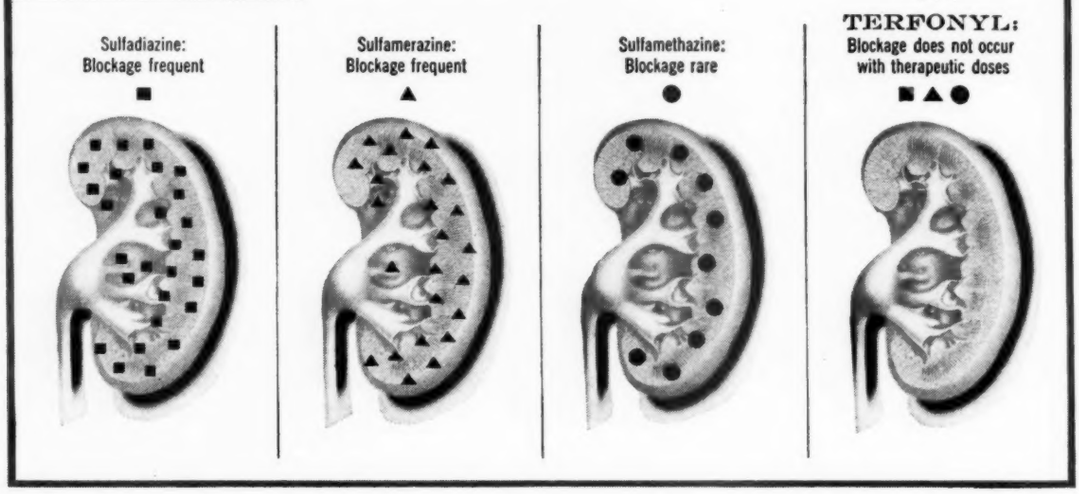

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to feed the flame of youth... or bank the embers of age

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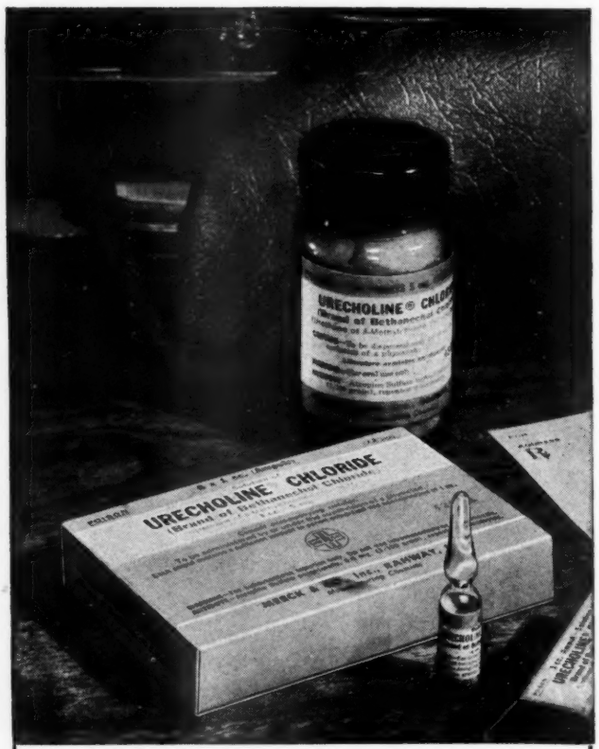

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1. Barnett, S.E.: Eye, Ear, Nose & Throat Monthly 39:19 (Jan.) 1950.

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(Queries & Minor Notes, J.A.M.A. 141: 300, Sept. 24, 1949)

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Irvin Abell

1876-1949

A graduate of the Louisville Medical College in 1897, Dr. Abell studied in Berlin, Germany, in 1898, and practiced surgery in Louisville from 1900 to 1949. He received Honorary Degrees from six of the leading universities of the United States, was a member and served as President of many of the leading medical and surgical organizations of the United States. He was an Honorary Fellow of the Royal College of Surgeons of England and author of more than one hundred articles published in the medical literature.

During World War I, Dr. Abell was Commander of Base Hospital No. 59 and was Advisor in Medical Affairs to the United States Government during World War II.

A Fellow of the American College of Surgeons from its founding in 1913, Dr. Abell was President—1946-1947, and Chairman of the Board of Regents—1939-1949, and President and Chairman of the Board of Directors, The Franklin H. Martin Memorial Foundation—1946-1949.

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SURF ˆ CE-CHROMICIZING*

When gut chromicized after strands are spun and dried, cl ome concentration is usually high in surface layers and relatively low in the core. Core digests rapidly, but highly chromicized periphery survives for prolonged periods.

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**To illustrate this comparison, small laboratory trays are used. In commercial production, surface-chromicizing is done under tension. Both processes are performed in large vats.*

ETHICON TRU-CHROMICIZING

Before they are spun into strands, ribbons of gut are soaked in a chrome bath, permitting uniform deposition. Thus, the strand has the same chrome content from periphery to center.

Control of Suture Digestion in Tissue

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To assure uniformity, Ethicon chromicizes gut in the ribbon stage. This exclusive, more meticulous process we call Tru-Chromicizing. An alternative method, used by others, called surface-chromicizing, involves dipping finished, spun and dried suture strands in a chrome bath. These are the usual results of the two methods:

SURFACE-CHROMICIZING

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TRU-CHROMICIZING

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← CHROMICIZING BEFORE SPINNING

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Editorial

CARE OF THE SKIN FOLLOWING ILEOSTOMY AND COLOSTOMY

THE modern advancement in surgical operative procedures has placed emphasis on the permanency of ileostomy and colostomy. In the care of patients with these orifices a most distressing problem arises in the prevention and treatment of skin denudation. This denudation is most uncomfortable for the patient and very often is more disconcerting to the surgeon than any other delayed postoperative complication.

Study of this problem has led to the belief that the fundamental difficulty resides in the fact that the intestinal contents are alkaline and the skin is normally acid in reaction. This constant disparity in hydrogen-ion concentration results in a persistent antagonism between acid and base radicals, hence the marked skin denudation and excoriation around a colostomy or ileostomy.

The chemical composition of the intestinal secretions change in their progressive course from the jejunum to the colon. However, all the secretions are isotonic with serum and have sodium as their chief basic ion. Jejunal secretion is slightly acid, its chief radical being chloride. However, in the bowel the secretion becomes increasingly more alkaline with bicarbonate gradually replacing chloride as the predominating radical.

With this knowledge as a background serious injury to the skin is understandable. Alkaline intestinal contents from an ileostomy or colostomy continually bathe the skin which is normally acid in reaction. This constant irritation produces the skin denudation and excoriation.

In order to correct this fundamental disturbance either the intestinal contents should be made acid or the skin changed to alkaline. Since the hydrogen-ion concentration of the skin cannot be altered, the intestinal contents must be made innocuous to the skin. This could be accomplished by changing the intestinal secretions during their physiologic activity in the gastrointestinal tract; or the intestinal contents must be prevented from irritating the skin about the colostomy or ileostomy. Since the former procedure cannot be accomplished without seriously disturbing the acid-base harmony of the body, the latter course must be pursued. With this objective in view a method is available which satisfies this necessity.

The care of the skin begins at the operating table. Prior to making the operative incision no alkaline antiseptic should be

used. The reason for this is that alkaline solutions remove keratin which is the first protective skin layer. After the surgical procedure the skin about the stoma is painted with 1 per cent salicylic acid solution in compound tincture of benzoin. The tincture of benzoin forms a protective film for the skin. The salicylic acid is a keratoplastic which stimulates epithelial growth thus aiding in the formation of keratin.

When the ileostomy or colostomy has begun to function, the area is mechanically cleansed with 10 per cent solution of sodium hexametaphosphate, a buffering solution which neutralizes the alkaline intestinal excretions. This same solution has been instilled in colostomy orifices without unusual effects. When the skin has been thus cleansed, it is exposed to the air to dry. Evaporation of the moisture may be accelerated by applying the heat of an ordinary lamp to the exposed area. Following this treatment the skin is painted with tincture of benzoin. Each application of the tincture increases the thickness of the protective film thus enhancing the efficacy of the film layer. This procedure is followed whenever the colostomy dressing is changed. In those cases in which skin denudation has already occurred, moist applications of 10 per cent sodium hexametaphosphate are used. As improvement becomes evident, the tincture of benzoin is applied; and the previously described method is followed thereafter.

This procedure of skin care is not difficult to follow. After the first and second dressings nurses perform the task without complaint. This method has been employed in many neglected colostomy cases with satisfactory results. However, those patients who have been followed from the time of their operation are the most satisfactory group since they are kept free from all distressing skin denudation and excoriation. This is a potent factor in assisting the colostomy patients to adjust themselves to this alteration in their normal physiology.

BERNARD J. FICARRA, M.D.

Original Articles

THROMBOPHLEBITIS*

AN EVALUATION OF VARIOUS METHODS OF TREATMENT

JAMES M. SULLIVAN, M.D. AND BENEDICT R. WALSKE, M.D.
Wood, Wisconsin

THE voluminous literature which has appeared in the past five years regarding the effectiveness of the various treatments for thrombophlebitis is difficult to evaluate. The report of one method of treatment seems to be enthusiastically propounded by certain authors while other methods are just as enthusiastically supported by other men. It would appear that such enthusiasm is frequently unwarranted since a completely satisfactory method of treatment has not been established. In the meantime we work with such means that are at hand. The active treatment of thromboembolic disease may take one or more of three forms, namely, the use of anticoagulant drugs, lumbar sympathetic nerve block or vein interruption. The use of anticoagulant therapy is based primarily on the prevention of the extension of the thrombus until such time as it becomes firmly fixed to the wall of the vein when the patient may become ambulatory and thus increase the venous back-flow. Lumbar sympathetic nerve block effectively increases venous return by interrupting reflex arterial spasm resulting from the irritating inflammatory process within adjacent veins.[93] Vein interruption performed above the level of the thrombus stops the further propagation of the thrombus and fatal embolism. All three of these forms of treatment have been used extensively during the past several years by surgeons and internists alike and each has its advocate.

During the past two years at the Veterans Administration Hospital, Wood, Wisconsin, we have tried to evaluate these various types of treatment either alone or in combination with the others. For purposes of study we have considered first phlebitis of the saphenous system treated with ligation. Eleven patients were seen, the oldest of which was sixty-five and the youngest twenty-three. The average age was forty-five years. We had excellent results in eight and poor results in three. All three poor results were due to failure to recognize an accompanying involvement of the deep veins. The eight patients in whom involvement of the saphenous system alone occurred made dramatic recoveries after ligation of the saphenous vein at the saphenofemoral junction and their symptoms rapidly subsided. Ligation was performed bilaterally in one case and unilaterally in ten cases; the phlebitis was primary in six and recurrent in five. No doubt many men would believe these patients could just as well have been treated with application of elastic bandages but we are firmly convinced morbidity can be markedly shortened by ligation and the possibility of extension into the deep circulation completely prevented.

Nine of our cases of saphenous vein

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phlebitis occurred in ambulatory patients and only two occurred in bed patients. The presence of varicose veins in seven patients seems to indicate that this is a prominent predisposing cause of thrombophlebitis of the saphenous system. It would follow from this observation that all varicosities should be actively treated and eliminated not only to improve circulation of the extremities *per se* but also to prevent the development of future thromboembolic phenomena. One case of saphenous vein phlebitis had occurred postoperatively; one patient suffered with cardiovascular disease and three had other pathologic disorders.

The symptoms that were encountered in this group of eleven cases are as follows: Pain and tenderness were found in eleven instances, swelling ten, color changes eight, local heat seven, fever four and Homans' sign two; pain, tenderness and swelling are directly over the course of the saphenous vein. The vein itself can usually be felt as a tender cord in its usual anatomic position. The fact that Homans' sign was present in two cases indicates that deep thrombophlebitis was already present and should have been recognized as such. The three poor results which were due to involvement of the deep system were eventually recognized and following treatment of the deep circulation they, too, made a complete recovery.

A study was then made of seventeen cases of thrombophlebitis of the extremities in which the deep veins were involved. The oldest patient was seventy-two and the youngest thirty-two; the average age was fifty-four years. The phlebitis was primary in eight cases and recurrent in nine. Ligation was performed bilaterally in five cases and unilaterally in twelve cases. We are now doing bilateral ligations in all cases even though the disease can be recognized in only one extremity. This change in therapy has come about because of the difficulty in recognizing a silent process in the opposite extremity. This is further emphasized by numerous reports appearing in the literature in which following ligation in one extremity a fatal embolus has arisen from the opposite extremity.[38] It has also been our experience that if the superficial femoral vein is ligated, there is very little if any postoperative edema. We have tried a few ligations of the common femoral vein and a few of the iliac but at the present time all our ligations are restricted to the superficial femoral vein. If it is thought the clot is much higher and cannot be sucked back through the superficial femoral, we believe a vena cava ligation is indicated. The results of these seventeen cases were excellent in thirteen, good in three and poor in one. The poor result was due to a technical error in not recognizing an associated thrombophlebitis of the saphenous system which produced a fatal pulmonary embolism. The preoperative status of these seventeen cases shows twelve to be ambulatory and five confined to bed. Four of the total were postoperative and five had severe varicose veins present; seven had cardiovascular disease and ten had other pathologic disorders.

The most common symptoms found in deep thrombophlebitis of the extremities are as follows: Pain and tenderness (in fourteen instances), swelling (thirteen), the positive Homans' sign (nine) and a mild degree of fever (ten) were the usual symptoms noted. Increased pulse was noted in eight, color changes six and increased heat two. The cases detected early, namely, those which would be classified by Homans as "bland thrombosis"[95] and by Ochsner and DeBakey as "phlebothrombosis,"[94] had very little swelling or fever present but pain and tenderness and Homans' sign were usually to be found. We believe that it serves no useful purpose to differentiate phlebothrombosis from thrombophleibtis other than the fact that one is an earlier form of the same disease and, of course, the possibility of pulmonary embolus is more likely in the early stages of this disease.

In those cases of thrombophlebitis in which patients were treated with vena cava

ligation four cases were primary and six were recurrent. The oldest patient was sixty-two and the youngest twenty-three; the average age was 45.7. The results were excellent in two cases, good in three and poor in five. In the two excellent cases one patient was a woman who had had a neglected thrombophlebitis which had spread up into the vena cava. A clot was sucked out of the vena cava until free bleeding was obtained and the vessel was then ligated. The postoperative improvement in this case was dramatic; her symptoms subsided within forty-eight hours and there was no swelling present. (Fig. 1.) The other excellent result was in a male. A clot was also removed from his vena cava following which ligation was performed. The three good results had their disease immediately arrested by ligation but there was a certain amount of edema and pain in the extremities which gave them a small amount of disability for six months to a year. The five patients whose results we have classified as poor also had their disease arrested but the disability caused by pain and swelling was such that we believe we must classify them as poor results. In the course of time the disability has decreased and the swelling has lessened. However, one case has already gone over a year and still has a moderate amount of swelling present. One of the patients whose result was classified as poor died of a mesenteric vein thrombosis one year, ten months after vena cava ligation. Autopsy in this case confirmed a diagnosis of thrombophlebitis migrans which had been suspected clinically. Another patient whose result was classified as poor died of hypernephroma eight months after vena cava ligation. From our observation of these ten cases vena cava ligation is not the innocuous procedure the perusal of many articles in the literature would indicate. Our worst results were found in those cases in which the thrombophlebitis was confined to only one extremity and a vena cava ligation was performed, followed by severe swelling and pain in the previously normal extremity.

FIG. 1. Thrombophlebitis involving deep and superficial veins of both lower extremities with extension to the inferior vena cava. Thrombophlebitis involving the right extremity of six weeks' duration; left extremity of one week's duration; bilateral edema of three days' duration. Vena cava ligation on July 19, 1948, with excellent postoperative course.

This pain and swelling in the normal extremity took much longer to clear up than the leg in which the primary disease originated. In all these vena cava ligations the concomitant right lumbar sympathectomy was also performed. In regard to the preoperative status of those patients with cases of thrombophlebitis treated with vena cava ligation, unilateral involvement was present in seven of these cases and they might better have been treated with ligation of the superficial femoral after sucking out the clots present. There was bilateral involvement in three. It will be noted that nine occurred in ambulatory patients and four occurred postoperatively. In four cases the thrombophlebitis was primary and in six it was recurrent.

There were only two cases in which treatment consisted solely of lumbar sympathetic block; these cases were both mild. One patient received nine blocks, the other received three blocks and they were both discharged from the hospital with what was considered to be a fairly good result. Follow-up on these cases has been impossible to obtain.

It was decided to compare our surgically treated cases with those treated by the anticoagulants. It was difficult to obtain adequate records of many of the cases treated with anticoagulants. It was also difficult to find a series of carefully controlled, adequately treated cases. Unless the prothrombin time is maintained between 20 and 35 per cent, treatment is not considered adequate. In spite of these difficulties we collected twelve cases worthy of comparison (seven deep, five superficial). There are ten good results and two poor results. There were three recurrences in one case but all the recurrences yielded to further anticoagulant therapy. It was primarily in nine cases. One patient also had a possible pulmonary embolus while under treatment which, however, was not substantiated by an x-ray examination. The general results of the Dicumarol-treated cases were not as dramatically obtained as those in which ligation had been done, and took on an average of seventy-two hours to ten days before the disease appeared to be under control. Complications, however, were not of great magnitude. The thrombophlebitis was bilateral in two cases and unilateral in ten. The oldest patient was seventy-three and the youngest twenty-two; the average age was forty-six years.

The pretreatment status in the group treated with Dicumarol shows seven to be ambulatory and five confined to bed. One was postoperative and six had varicose veins present; six had cardiovascular disease and seven had other pathologic disorders. As in the surgically treated cases it will be noted that the presence of varicose veins again occurs in slightly under 50 per cent.

Nine patients were treated with symptomatic measures only; the results were fairly satisfactory in eight and poor in one. The oldest patient was fifty-nine and the youngest twenty-six; the average age was fifty years. The thrombophlebitis was bilateral in two cases and unilateral in seven. In four cases the thrombophlebitis was primary and in five it was recurrent. This is too small a series to draw many conclusions from; nevertheless, it was found that the length of treatment greatly exceeded both those treated with anticoagulants and those treated surgically. There were no complications such as pulmonary embolus in these nine cases because if this had happened active therapy with the anticoagulants or surgery would have been instituted. The residuals, however, of a postphlebitic syndrome with damaged valves and swollen legs were considerably higher than in either of the other groups.

COMMENTS

From the foregoing presentation it is very difficult to arrive at any profound conclusions as to which therapy is the most efficacious. The series is admittedly small but the vast majority of cases was personally studied by the authors and are therefore productive of more information than is apparent. Studies of large series of cases frequently become impersonal and the evaluation is merely that of variable recorded data. We believe that such may sometimes be responsible for the equally good reports for the various methods of treatment.

A review of the literature[1–123] and a study of our results lead us to believe that the therapy should be fitted to the individual case and that combinations of treatment should be used in many cases. As previously mentioned we believe that the results of surgical treatment for thrombophlebitis of the saphenous system are uniformly good. Ligation of the veins of the saphenous system is a minor procedure and morbidity is markedly reduced; it is for this reason that we believe it is the treatment of choice. In deep thrombophlebitis in which diagnosis is made early ligation offers maximum protection against embolism by a relatively easy, quick treatment resulting in few complications. The operation, of course, must be performed by a surgeon familiar with the technic. As previously pointed out we are not so enthusiastic about ligation of the vena cava.

The operation is a major procedure and the postoperative sequelae are appalling.[49] It is recommended only when a bilateral process is believed to be extending into the vena cava or when a unilateral process cannot be sucked back through an opening in the femoral vein. The results of treatment with anticoagulants are also good; however, there are two disadvantages. Dicumarol therapy with impaired liver function may readily result in a dangerous hemorrhagic state. The second disadvantage is the need of frequent accurate laboratory control of coagulation time with heparin and prothrombin time with dicumarol. This is absolutely necessary not only to prevent a dangerous hemorrhagic state but also to maintain adequate therapeutic levels of the drug being used.

CONCLUSIONS

1. Recent literature on thrombophlebitis is voluminous and often confusing.

2. Ligation for thrombophlebitis of the saphenous system appears to be the treatment of choice.

3. Ligation for early thrombophlebitis of the deep veins gives maximum protection against embolism and is a relatively easy procedure in competent hands.

4. Ligation of the vena cava is a major procedure prone to end in serious postoperative sequelae and is to be recommended only in bilateral disease which extends into the vena cava or unilateral disease in which the clot cannot be sucked back through the femoral vein.

5. Anticoagulant therapy is effective and has its place, especially in the treatment of thrombophlebitis of the deep veins. It, however, does not give maximum protection against embolism and has the disadvantages of producing a hemorrhagic state and of requiring frequent and accurate laboratory control.

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THE MANAGEMENT OF PENETRATING AND PERFORATING WOUNDS OF THE CHEST IN CIVILIAN PRACTICE*

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WE have recently presented a review of 109 patients with multiple rib fractures treated in a civilian hospital.[1] We now present a series of penetrating wounds of the chest treated in the same institution. Many problems are common to both penetrating and nonpenetrating chest injuries.

Presented herein are cases of consecutive patients treated over a two-year period on the general surgical service of a metropolitan hospital. The staff is in agreement on the fundamental aspects of treatment so that all patients are treated uniformly. Thoracic surgeons are available for consultation and are made use of freely.

Of the 119 patients, 93 were stabbed and 26 were shot; 90 of these were negroes and 101 were males. The average age is 34.26 years compared to 50 years in 109 patients with multiple rib fractures. Table 1 lists the patients by decades. The incidence of associated alcoholism is very high. Fifteen per cent of the stabbings were multiple, involving both sides in 3 per cent. Seventy-two per cent were on the left side alone and 25 per cent on the right. There is a consistent tendency in all chest trauma for the left side to be wounded more frequently. This has been noted in fractured ribs[1] and is most pronounced in stab wounds of the chest. The gunshot wounds were on the left side alone in 57.6 per cent, on the right in 38.4 per cent and bilateral in 4 per cent. The more frequent involvement of the left side, especially in stabbings, has been noted by others.[2] Only 23.6 per cent of the stab wounds were delivered to the back.

The time interval between wounding and admission to the hospital is short. Initial treatment is carried out in the Emergency Room. This consists of measures to combat shock, stop hemorrhage and tamponade sucking wounds. The patient is then thoroughly examined. His general condition is assessed and the wound inspected, noting its position and relationship to underlying structures such as the heart, great vessels, diaphragm and abdominal contents. Digital examination of the wound is carried out if this is possible. Negative results from this examination mean nothing but occasionally one may feel a hole in the diaphragm. Stab wounds are closed and gunshot wounds are débrided and dressed without closure. Tetanus antitoxin or, if appropriate, tetanus toxoid is given. None of these measures will interfere with the early administration of blood, plasma, fluids or nasal oxygen.

TABLE 1
AGES BY DECADES, 119 PATIENTS

1–10	0
11–20	9
21–30	45
31–40	33
41–50	17
51–60	12
61–70	3

Penetration of the pleura is commonly accompanied with shock. Studies of this phenomenon suggest that this is due to a reflex peripheral dilation.[3] Recovery from this is rapid; hence the response of the patient gives us an important clue as to whether a more serious injury underlies the wound. Shock which continues in spite of good therapy should immediately arouse suspicion. One should begin the search for progressive bleeding into the chest,

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tension pneumothorax, obstructed airways, great vessel injury or cardiac tamponade.

Early thoracentesis is important both for diagnosis and for treatment. If improvement follows the withdrawal of a quantity of blood or air, one should institute underwater thoracotomy tube drainage at once. The advantages of performing this early are as follows: (1) A fairly reliable guide as to the quantity of bleeding is obtained and if this continues, one may be led to explore the chest and control it; (2) if tension pneumothorax is causing the patient's difficulties, the institution of water-seal drainage is the ideal therapy and (3) restoration of the normal anatomic and pressure relationships of the thoracic organs is important in the recovery of normal cardiorespiratory function. Bleeding from the lung is seldom the cause of continuing shock. The pressure in the pulmonary vessels is approximately one-fourth of that of the systemic circulation.[4] Intercostal or internal mammary arteries with a much higher pressure may easily bleed continuously or intermittently and cause severe shock.

Obstructed airways are almost always the result of aspirated material or blood from the lung tissue itself. The customary position of patients on the examining table is such that vomitus is aspirated by force of gravity in the unconscious patient. This position is also a hindrance to a patient who tries to expel material from the nasopharynx. The dangers of aspiration may be mitigated by placing the unconscious patient on his side and by emptying the stomach with a Levin tube. One should never hesitate to use the bronchoscope to remove particulate matter, blood or secretions. All patients who are scheduled for emergency exploratory laporotomy or thoracotomy should have a Levin tube introduced in order to empty the stomach. Our anesthesiologists who are generally more aware of the dangers of aspiration than the surgeons are insistent on this point.

Great vessel injury is more likely to result from wounds about the clavicle and upper sternum. These injuries can be successfully treated by surgery provided prompt action is taken. Strangely enough, many of these patients make a temporary recovery only to expire suddenly a few hours later. Presumably the wounds in the vessel are plugged with clot which is later dislodged as the blood pressure rises and the shock is overcome.

Cardiac tamponade, the last major cause of continuing shock, requires most urgent treatment. Distended neck veins, paradoxical and soft, fast pulse, absent heart sounds, enlarged heart shadow on x-ray, absent pulsations under fluoroscopy in the upright position and subsequent electrocardiographic changes are all well recognized manifestations of this injury. One may also resort to pericardial tap for further confirmation. Neck vein distention, absent pulsations under fluoroscopy and enlarged heart shadow should be sufficient to establish the diagnosis. An occasional heart wound will escape notice and not lead to death.

All necessary diagnostic procedures should be done as early as possible. Unless the patient is in an extremely poor condition, we insist on x-rays on admission. Others[5] also emphasize the value of complete and adequate x-rays. Besides an upright chest film it may be necessary to obtain a scout film of the abdomen, lateral films to locate missiles and spot films in the case of spine fractures, etc. Reliance is never placed on physical examination alone. X-ray examinations are repeated frequently.

After a complete evaluation of each patient is obtained, specific therapy is undertaken. Although some[6] advocate surgery on all or nearly all penetrating chest injuries on admission, we only resort to surgery when specific indications are present. These are injury to abdominal organs, cardiac injury, great vessel injury, continued bleeding into the chest and organizing hemothorax (a late development). Closure of sucking wounds and digital

examination of them is a minor procedure. Almost all of these patients received penicillin. It is necessary to have a good blood bank available[9] and expert anesthesiologists.

COMPLICATIONS AND SEQUELAE

Most of these patients had complications which were easily detected. Table II lists the complications encountered. The recent war added greatly to our understanding of chest trauma and many[7,8] have stated that our war experiences are logically and easily applied to civilian injuries.

TABLE II
COMPLICATIONS ENCOUNTERED IN ALL PATIENTS

	Gunshot Wounds, 26 Patients		Stab Wounds, 93 Patients	
	No.	Per cent	No.	Per cent
Hemothorax	23	88.0	77	82.7
Pneumothorax	15	57.6	68	73.1
Tension pneumothorax	..	....	3	3.1
Emphysema	15	57.6	40	43.0
Empyema	..	....	3	3.1
Thoracico-abdominal wound	8	30.7	10	10.7
Ileus	5	19.0	7	7.5
Transverse myelitis	2	7.6		
Cardiac wounds	..	....	2	2.1
Organizing hemothorax	1	3.4	3	3.1
Deaths	5	19.0	1	1.07

Hemothorax. Hemothorax was present in 88 per cent of the gunshot wounds and 82.7 per cent of the stab wounds. Other authors report an incidence of 51 per cent,[2] 77 per cent[10] and 62 per cent.[11] If only the costophrenic angle is blunted, the hemothorax is considered slight. If one-half of the pleural space is filled or if 1,000 cc. of blood are obtained on thoracentesis, it is considered severe. Cases which fall between these two grades are classed as moderate. Hemothorax is more severe in the gunshot-wound patient. (Table III.) Our objective in the treatment of hemothorax is to remove as completely as possible all but the slightest accumulations of blood and to keep the pleural space obliterated. This is far different from older methods of cautious withdrawal of blood or replacement of air[12] but present day experience warrants the practice.[13–16] Either thoracentesis or underwater thoracotomy tube drainage was used on two-thirds of the patients with stab wounds and in twenty-two of twenty-six of those with gunshot wounds. To accomplish its purpose thoracentesis must be performed repeatedly and even daily. A thoracotomy tube placed in the seventh interspace in the midaxillary line will be effective if the following precautions are observed: (1) The connections must be securely taped to prevent accidental uncoupling; (2) the tube must be sewed in to insure that the openings remain in the pleural space; (3) the tube must be inspected daily to insure patency and to dislodge clots; (4) attendants must understand the principle so that the water bottle is never emptied, inducing an open pneumothorax and (5) the tip of the tube must be just under the water and no deeper or else the force required to expel blood or air will be too great.

TABLE III
DEGREE OF SEVERITY OF HEMOTHORAX IN EACH CATEGORY

	Gunshot Wounds, 23 Patients		Stab Wounds, 77 Patients	
	No.	Per cent	No.	Per cent
Slight or mild	6	26.08	38	49.3
Moderate	6	26.08	20	25.9
Severe	11	47.84	19	24.8

Keeping the pleural space dry is important in reducing the incidence of organizing hemothorax. The pathology of hemothorax and the indications for decortication have been well described.[17,18] In spite of our attempts to prevent it three (3.1 per cent) with stab wounds and one (3.4 per cent) with a gunshot wound required decortication because of organized hemothorax. It seems impossible at the present time to

predict which patients will develop organizing hemothorax and which will absorb the fluid; therefore, we think it is necessary to continue efforts to empty the pleural space.

Pneumothorax and Emphysema. Pneumothorax occurred in 57 per cent of those with gunshot wounds and in 73 per cent with stab wounds. Subcutaneous emphysema was present in 57 per cent of the former and only 43 per cent of the latter. In those with fractured ribs[1] emphysema was much more common than pneumothorax.

Three patients, all with stab wounds, developed a tension pneumothorax. All were treated with the underwater thoracotomy tube which must be introduced as soon as the condition is suspected. Tension pneumothorax arises when a laceration of the lung or, less commonly, the thoracic wall is shaped and placed so that air enters the pleural cavity on inspiration only to be trapped there on expiration. The net result is a gradual increase in intrapleural pressure, displacing the mediastinum to the opposite side and encroaching on available respiratory space. There are harmful effects from the displacement of the mediastinum alone but the chief difficulty is the increasing intrapleural pressure. To create a negative pressure the patient increases his respiratory amplitude. Since the ball-valve action of the laceration is still functioning, he must still further increase the depth of respirations. A point is reached where neither the maximum depth of respiration or the maximum rate will suffice and the patient expires from asphyxia. The introduction of the thoracotomy tube reverses this trend immediately.

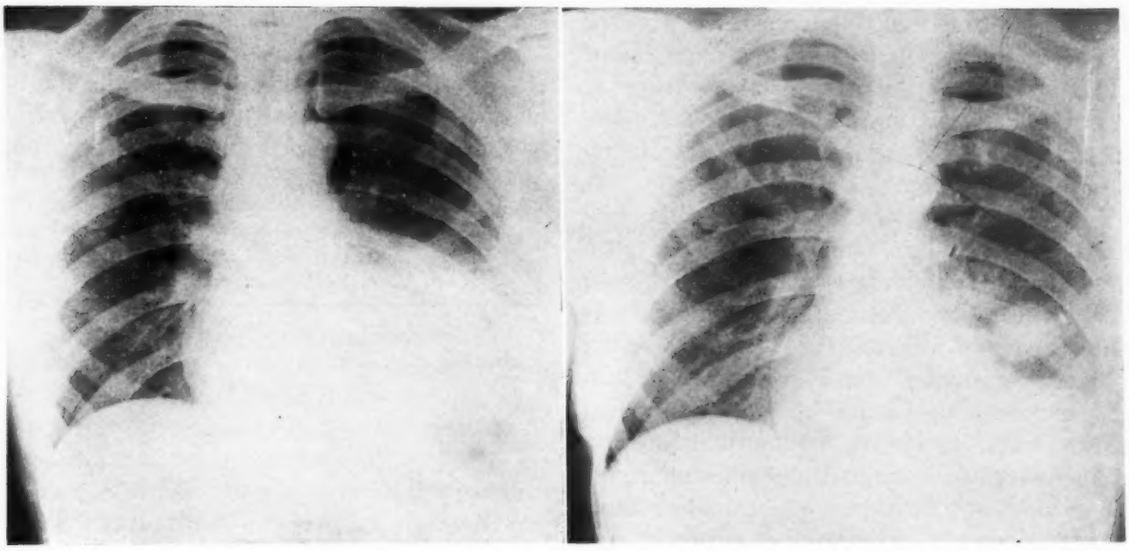
Graham[19–21] elucidated the pressure relationships in both open and tension pneumothorax. We have also come to realize that cardiac and respiratory functions are forever interdependent. Although many factors such as vital capacity, cardiac reserve, etc., enter into our considerations, we cannot determine the exact importance of them individually. As a consequence, each patient reacts differently to what seems to be similar circumstances. We speak of the cardiorespiratory reserve, taking this term to be a summation of all the aforementioned factors.

A few of these patients had open pneumothoraces which were rendered harmless by prompt closure or tamponading. If allowed to be undisturbed, the air will eventually be absorbed. The time required varies greatly and in addition the risk of pleural effusion exists. In our opinion it is better to re-expand the lung by means of thoracentesis which may have to be repeated or by an underwater thoracotomy tube. With thoracentesis there is some danger of puncturing the lung and there may be difficulty in obtaining all the air in one operation; hence we prefer the thoracotomy tube. A small amount of air is expressed with each expiration and soon the lung is re-expanded. All the precautions mentioned previously for the care of the thoracotomy tube must be strictly observed. Some patients with slight amounts of air present may be treated conservatively but we believe moderate or large quantities should be removed. We remove the thoracotomy tube three or four days after complete expansion is obtained. There is very little likelihood of recurrence.

One patient developed pneumothorax following brachial block anesthesia. It is easy to perforate the apex of the pleura during this procedure and one should keep the needle opening plugged at all times with a stylet, a finger or a syringe.

Wounds of the diaphragm will permit pneumothorax to develop during exploratory laporotomy. If a wound in the diaphragm is suspected, it should receive first attention on entering the abdomen.

Laceration in the Lung. Wartime experience[22] indicated an incidence of less than 2 per cent of lung abscess following penetrating wounds of the chest. No lung abscesses were encountered in this series. Figure 1 illustrates the course of one patient with a gunshot wound of the chest. Gunshot wounds produce a contused laceration and in addition introduce foreign material,



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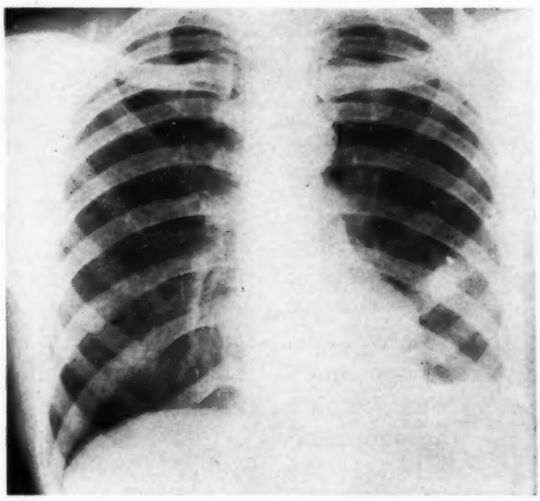

1C

FIG. 1. This series illustrates the healing of contusion of the lung along the course of a penetrating gunshot wound; C, taken three weeks after wound was incurred; the healed area is of almost metallic density.

but in none of our twenty-six cases (a small number) did serious infection develop.

Empyema. Three patients, all with stab wounds, developed empyema. Many instances occurred in which the pleural space was contaminated with foreign objects and either gastrointestinal or colonic content without the development of empyema. The routine use of antibiotics and measures to keep the pleural space dry and obliterated are responsible we believe for this low incidence. A dead air space which contains blood or exudates is conducive to infection. Both the pleura and the lungs have great resistance and reparative powers.

Cardiac Wounds. The diagnosis of cardiac wounds has been mentioned. Many patients must expire immediately from large wounds and damage to the coronary arteries or conduction system. The prevailing belief is that cardiac wounds are dangerous because the pericardial sac fills with blood and prevents the heart from filling during diastole. The actual blood loss is of secondary importance. Ravitch

and Blalock[23] have successfully treated some of these injuries by aspiration alone. This procedure should also be valuable as a means of improving the patient's condition while preparations are being made in the operating room.

Two patients with stab wounds had injury to the heart. One was operated upon and his left ventricle was repaired shortly after admission. Because of indefinite findings the other was observed. His pericardial shadow gradually increased in size and on the eleventh day 2,000 cc. of sanguineous fluid were removed by pericardotomy. There were no electrocardiographic changes. It is possible that the accumulated fluid resulted from a lacerated pericardium and not myocardium.

Thoracico-abdominal Wounds. The peritoneal cavity extends well into the thorax; hence it is easy for the abdominal organs to suffer injury through a perforated diaphragm. Ten patients (10.7 per cent) with stab wounds and eight (30.7 per cent) with gunshot wounds had injury to abdominal organs. Three patients, all with gunshot wounds, expired giving a mortality of 37.5 per cent in patients with thoracico-abdominal injury due to gunshot wounds. Others report mortalities of 22 per cent[11] and 27.3 per cent.[24] Ten of our patients were explored through the abdomen and eight through the chest. Table IV lists the organs involved and frequency of injury. The liver is the organ most frequently involved when injury is due to gunshot wounds.[25,26] With the exception of the pelvic colon, bladder, female genital organs and terminal ileum and cecum, all abdominal organs can be easily reached through the left diaphragm, making the left thoracic approach very feasible. The diaphragm is most easily repaired from the chest.

When the right side is wounded, we have usually opened the right chest and through this approach repaired the liver and right diaphragm. Before the diaphragm is closed a Penrose drain is placed in the subphrenic space and led out through a stab wound of the abdomen. This prevents accumulation of bile about the repair in the diaphragm and also reduces the likelihood of subphrenic abscess. If the wound in the diaphragm and liver is not repaired, bile empyema is a serious complication.[27]

TABLE IV
ORGANS INVOLVED AND FREQUENCY OF INVOLVEMENT IN THORACICO-ABDOMINAL INJURY

	Gunshot Wounds, 8 Patients	Stab Wounds, 10 Patients
Liver	4	1
Spleen	1	1
Pancreas	1	
Kidney	1	
Stomach	1	4
Ileum	1	2
Colon	3	2

There is no set rule for approaching a thoracico-abdominal wound.[25] In stab wounds of the left side we would agree with some[28] that the left thoracic approach is superior. However, either laparotomy or thoracotomy may be sufficient and it may be necessary to use both approaches.

Miscellaneous Complications. Ileus, including gastric dilation, occurred in seven patients (7.5 per cent) with stab wounds and in five (19 per cent) with gunshot wounds. The latter group suffered a much higher rate of abdominal organ injury. Ileus will add to the cardiorespiratory difficulties to a very serious degree. Gastric dilation is treated with a Levin tube and small bowel ileus with intestinal intubation.

To prevent or at least moderate wet lung we make patients ambulatory early, encourage coughing, relieve pain by intercostal blocks and, if necessary, resort to endotracheal aspiration and bronchoscopy. These measures are valuable and have been more thoroughly described elsewhere.[1,29–31]

Two patients, both with gunshot wounds, suffered section of the thoracic spinal cord. One of these patients died on the eighteenth day.

No instances of injury to the esophagus were encountered in this series.

Deaths. Five patients (19.2 per cent) with gunshot wounds and one (1.07 per cent) with a stab wound died. In patients with gunshot wounds other authors report mortalities of 14.8 per cent,[4] 17.3 per cent,[10] 15.6 per cent[32] and 36 per cent.[33] One author[33] reports a mortality of 19 per cent in stab wounds and another[2] 14.8 per cent in a series made up of both stab and gunshot wounds.

Of the five patients with gunshot wounds who died, three had abdominal injury as well. The death of one is attributed solely to failure to recognize the abdominal injury. He had perforations of the small bowel and sigmoid which were not repaired until twenty-four hours after injury. Death was due to peritonitis. A second patient was a severe diabetic who had perforation of stomach, liver and colon. She never fully recovered from her shock and expired in twenty-four hours. The third had a shattered spleen and left kidney, a laceration of the liver and perforation of the colon. This patient was explored through the abdomen without realizing that the diaphragm was perforated. The next day complete collapse of the left lung with a massive hemopneumothorax was found. This patient died on the fifth day with anuria.

Of the remaining two patients who had gunshot wounds, one died of shock within three hours of admission and the second, who also had a transection of the spinal cord at D_{10} and right hemopneumothorax, died on the eighteenth day after a pulmonary embolism.

The one patient who expired after being stabbed died because of an unrecognized great vessel injury. His wound was located in the left second interspace in the midclavicular line. Death came suddenly in forty-eight hours. On retrospect there seemed no valid reason for missing this complication since it was obvious that the patient was doing poorly. This fact plus the location of the wound should have resulted in surgical exploration.

March, 1950

SUMMARY

1. Ninty-three patients with stab wounds and twenty-six with gunshot wounds are presented.

2. There is a higher incidence of injury on the left side.

3. A general plan of management is presented, emphasizing those conditions which cause continued shock.

4. Few escape a complication. Our methods of management of hemothorax and pneumothorax are outlined.

5. Serious infection in the lung parenchyma did not occur and empyema followed in only three cases.

6. Cardiac injuries are discussed.

7. Thoracico-abdominal wounds are very serious, especially when due to gunshot wounds. One patient died because the relationship of the abdominal viscera to the thorax was not appreciated at the moment.

8. Gunshot wounds cause a high mortality, a large proportion of which results when abdominal viscera are also damaged.

9. A death due to a stab wound involving a great vessel occurred. This was preventable.

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PROLONGED SPINAL ANESTHESIA USING EPHEDRINE SULFATE INTRATHECALLY

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SINCE the advent of spinal anesthesia there have been many methods devised to prolong the duration of the anesthesia. Continuous spinal anesthesia is probably used as much as any method to maintain a long period of anesthesia. It is the purpose of this paper to present 300 surgical cases using ephedrine sulfate, pontocaine and dextrose for prolonged spinal anesthesia. Loss of sensation from two to two and a half hours using minimal doses of pontocaine is recorded in this article.

As shown in Table 1 it has been the rule to use 5 to 7 mg. of pontocaine for abdominal operations, i.e., appendectomy, hysterectomy, herniorrhaphy. Before the use of ephedrine intrathecally 10 to 18 mg. of pontocaine were used in most abdominal operations. Romberger in 1943 mentioned the use of ephedrine[1] and more recently has presented a large series of cases in which ephedrine was used intrathecally.[2]

When I first began using ephedrine sulfate intrathecally, standard amounts of pontocaine plus 50 mg. of ephedrine were administered. However, the prolongation of anesthesia was so great that smaller and smaller amounts of anesthetic agent were used and the amount of ephedrine was cut to 30 mg. Five and 10 mg. of ephedrine were tried in a few cases without good results. Since 30 mg. of ephedrine gave uniformly good results, this amount was the standard used. Thus two factors were developed by the use of ephedrine sulfate. First, the period of anesthesia was prolonged. Often a 100 per cent increase in the total time of anesthesia was obtained. Second, it became possible to reduce the total amount of anesthetic agent used.

In the 300 cases reported 10 mg. of pontocaine was the maximum used. Anesthesia has been obtained up to two and one-half hours in operating on the gallbladder with 10 mg. of pontocaine. The smallest concentration of pontocaine has been 5 mg.

METHOD OF PREPARING SOLUTION FOR INJECTION

The anesthetic used was pontocaine hydrochloride. When the crystalline pontocaine hydrochloride is used, 2 cc. of 10 per cent dextrose is used to dissolve the crystals. The necessary amount of solution is then drawn into the syringe depending on the concentration of pontocaine desired. To this add 1.5 parts of 10 per cent dextrose. Thirty mg. of ephedrine sulfate are then added to the solution in the syringe from a sterile ampule of ephedrine sulfate. The technic of using 10 per cent dextrose to make a hyperbaric solution was first described in 1935[3] and has been reemphasized more recently by Eversole.[4]

When pontocaine hydrochloride 1 per cent solution is used, the amount of solution required, depending on the concentration desired, is drawn into the syringe; and 1.5 parts of 10 per cent dextrose and 30 mg. of ephedrine sulfate are added to the solution.

LEVELS OF ANESTHESIA

For perineal and lower extremity surgery the level of skin anesthesia is carried to halfway between the umbilicus and the symphysis pubis. The anesthetic agent is at about lumbar 1 in the spinal canal.

For superficial operations in the lower part of the abdomen the level of skin

anesthesia is raised to the umbilicus or slightly above. The anesthetic agent is at about thoracic 10 in the spinal canal.

For operations in the lower or mid-abdomen the level of skin anesthesia is raised to the costal margins or, if the procedure requires some exploration, the level is raised to halfway between costal margin and nipple line. This places the anesthetic agent in the canal at about thoracic 6.

For complete abdominal exploration or upper abdominal surgery the skin level of anesthesia is raised to the nipple line. The anesthetic solution is at about thoracic 4 in the spinal canal.

COMPLICATIONS

We have had no unusual complications with this technic. On the contrary, it appears that the complications of spinal anesthesia often seen have not been as frequently encountered.

In the entire series we have never had the bottom fall out of the blood pressure. Maximal fall of blood pressure has ranged between 20 and 30 mm.; more frequently

TABLE 1

Operation	Dosage	Duration	No.	Age	Supplemental	Deaths
Appendectomy	4–6 (av. 5)	20–85 (av. 44)	96	17–54	0	0
Supravaginal hysterectomy	7–8 (av. 7.1)	90–120 (av. 87)	29	33–47	0	0
Total hysterectomy	7	60–120	8	42–51	0	0
Unilateral inguinal herniorrhaphy	5–7 (av. 5.3)	15–100 (av. 50)	74	18–70	0	0
Bilateral inguinal herniorrhaphy	5–7 (av. 5.5)	50–125 (av. 95)	19	37–63	0	0
Umbilical or ventral herniorrhaphy	5–7 (av. 5.5)	50–110 (av. 80)	8	55–61	0	0
Cecostomy and exploratory laparotomy	6	80–120 (av. 100)	4	60–70	0	1 8th postoperative day
Dilatation and curettage and exploratory laparotomy	6	75–100 (av. 80)	6	33–54	0	0
Perineorrhaphy and laparotomy	5–7	30–170	4	40–65	N_2O started on 130 minutes in one case	0
Suspensions and dilatation and curettage	5–10 (av. 7)	65–105 (av. 87)	15	22–43	0	0
Colectomy	5–8 (av. 8)	45–130 (av. 120)	5	40–74	0	1 3rd postoperative day
Bilateral hydrocelectomy	2	30	1	46	0	0
Incarcerated femoral herniorrhaphy with intestinal resection	6	90	1	58	0	1 5th postoperative day
Cholecystectomy	7–10 (av. 8.5)	90–130 (av. 110)	17	39–62	1 with .5% sodium pentothal 2 with 2% sodium pentothal 1 with N_2O and O_2	1 13th postoperative day
Suprapubic prostatectomy	5	55–68	9	60–71	0	0
Perforated peptic ulcer	6	40	1	22	0	0
Nephrolithectomy	6	55	1	.....	0	0
Exploratory laparotomy for ectopic pregnancy	7	40–55	2	22–41	0	0

In the entire series we have never had the bottom fall out of the blood pressure. Maximal fall of blood pressure has ranged between 20 and 30 mm.; more frequently

there is only the usual rise in blood pressure following injections of ephedrine sulfate.

Nausea, vomiting and retching are rarely encountered. In only one case was it necessary to put the patient to sleep to control nausea and retching.

No anesthetic deaths were encountered. Three patients died four, five and thirteen days postoperatively due to surgical complications.

Four cases of spinal anesthesia are not included in this series. In two cases the anesthetic level was never high enough to carry out the contemplated procedure. In two instances the expected anesthesia never appeared. All four cases were thought to be failures because of errors in injection technic.

COMMENTS

Besides the prolongation of anesthesia and reduction in the total amount of anesthetic agent required, the addition of ephedrine intrathecally may be responsible for other factors we have observed. Oxygen and intravenous solutions were always used as supportive measures during spinal anesthesia. However, with the use of Ephedrine intrathecally these measures have been much less in need. They are always available but not routinely used. Blood pressure fall, nausea and vomiting just do not occur as often when ephedrine is used intrathecally.

The onset of anesthesia has been somewhat slower when using ephedrine intrathecally. Up to twice as much time must be allowed for complete anesthesia to appear.

Just what the action of the ephedrine is when combined with an anesthetic agent is not exactly clear. Several important factors, however, are already known about the action of ephedrine. This was found to potentiate the action of novocain when added to local anesthetic solutions.[5] Five per cent of ephedrine hydrochloride is capable of blocking the sciatic nerve of the frog and the minimal anesthetic dose of ephedrine hydrochloride for spinal anesthesia is about .1 mg per Gm. in the frog. This is about ten times greater than the minimal spinal anesthetic dose of procaine in the frog. Since these effects of ephedrine hydrochloride on the sciatic nerve and when injected intrathecally in the frog have been completely reversible, it is assumed there is no nerve injury and ephedrine does not kill nerve substance.[6] In addition to being capable of blocking the sciatic nerve and inducing spinal anesthesia, ephedrine hydrochloride has been shown to have local anesthetic properties. One-tenth of 1 per cent of ephedrine hydrochloride produces anesthesia in the human when injected intracutaneously.

We had considered the action of ephedrine when injected intrathecally primarily that of vasoconstriction and prolongation of the anesthetic action by increasing the length of time the anesthetic agent would be allowed to act. However, the observations of Read and Lin and Schultz show that ephedrine not only has the property to potentiate the action of anesthetic agent but also that ephedrine in its own right is an anesthetic agent when used in large doses.

It should be noted that Whitacre has tried ephedrine and glucose solution in which the pontocaine has been left out. These solutions produced no anesthesia.[7] Thus in the size doses we are using the ephedrine probably acts only to potentiate the pontocaine and act as a vasoconstrictor.

SUMMARY

Three hundred cases of spinal anesthesia using ephedrine sulfate, pontocaine and 10 per cent glucose are reported. The results have been uniformly successful. The preparation of the solution for injection is easy. Early we used 50 mg. of ephedrine but rapidly decreased the amount to 30 mg. Five and 10 mg. of ephedrine have been tried in a few cases without good results. We have not used a concentration of anesthetic agent higher than 10 mg. This has produced adequate anesthesia. One and a half to two and a half hours of

anesthesia using 5 to 10 mg. has been sufficient time for most operations.

CONCLUSIONS

1. Ephedrine sulfate when added to pontocaine hydrochloride increases the working time of the anesthetic up to 100 per cent.

2. Minimal doses of anesthetic agent may be used when ephedrine sulfate is added to the anesthetic agent.

3. The action of ephedrine is not clearly understood but probably a dual role is played.

4. Complications have been absent.

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Shute et al. of London, Canada, have been working for a long time on the influence of large doses of Vitamin E in patients with various types of vascular disease. They have succeeded in healing indolent leg ulcers in patients with senile arteriosclerosis, in patients with thromboangiitis obliterans, etc. Some of their patients with cold and numb extremities of several years' duration had "suddenly become warm again." In other cases such as early gangrene of the extremities as well as in cases of cerebral or coronary thrombosis the authors report favorable results. Time will tell us the real value of such intensive therapy in the aforementioned conditions. Other clinics will first have to confirm these findings on similar patients. (*Richard A. Leonardo, M.D.*)

PROTECTION OF THE RECURRENT LARYNGEAL NERVES IN THYROIDECTOMY*

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IN thyroidectomy prevention of injury to the recurrent laryngeal nerves has always been a prime concern of the surgeon. Unilateral nerve injury must be regarded as a serious complication of thyroid surgery even though the glottic space for breathing remains reasonably adequate and eventual overcompensation on the uninjured side may provide a voice sometimes described as reasonably good.

Bilateral cord injury is decidedly calamitous. Tracheotomy may become necessary if the cords are in adduction. In other cases fibrosis of the vocal cords may eventuate together with arytenoid fixation.

Various methods of treatment have been suggested; many have been discarded. The most popular at the present time are modifications of the King technic first described in 1939. This operation enlarged the glottic space by transplantation of the omohyoid muscle to the base of one arytenoid cartilage and reconstruction of the larynx. Thornell of Cincinnati has been using a similar method by the oral approach and has omitted section of the muscle. One of my patients was operated upon by this approach and the result was very satisfactory.

While the results are surgically satisfactory by use of the aforementioned methods and are certainly a great improvement over the older methods of nerve suture, the voice necessarily remains partially impaired. Hence prevention of injury to these nerves remains as vitally important today as in the past.

Some years ago Crile[3] emphasized the apparent sensitivity of the recurrent laryngeal nerves and stated that the slightest direct or indirect pressure interferes with nerve conduction and at once effects a voice change. In Crile's opinion these nerves are naked as are the brain and spinal cord and, therefore, very soft and highly vulnerable. Lahey and associates[8] have presented much evidence that the recurrent laryngeal nerves closely resemble ordinary peripheral nerves in firmness and tensile strength and are not particularly vulnerable. According to Lahey even palpation, while the recurrent laryngeal nerve is on moderate stretch, does not result in interference with its function either immediately or at any time postoperatively. Lahey has stressed the advantages of routine dissection and visualization of these nerves in all thyroidectomies. Other surgeons also believe that demonstration of the recurrent laryngeal nerve largely eliminates injury to this structure.[11]

Traction on the nerve results as the lobe is rolled toward the midline; pull upon the inferior thyroid artery generally elevates the recurrent laryngeal nerve. Gentle traction is believed to have no harmful effect on the nerve. Recurrent laryngeal nerve damage may result from operative trauma, such as direct injury by knife, forceps or rough sponging or packing to control hemorrhage.

A number of operators prefer not to visualize the recurrent laryngeal nerve for several reasons.[2,7] It may be difficult to find the nerve; demonstration of the nerve may entail undue traction on the nerve; dissection requires great care and conceivably may cause hemorrhage and itself result in trauma and paralysis. Thus Cole[2] does not isolate the recurrent laryngeal nerve unless some anomaly is encountered. In poor risk patients the time factor is important.

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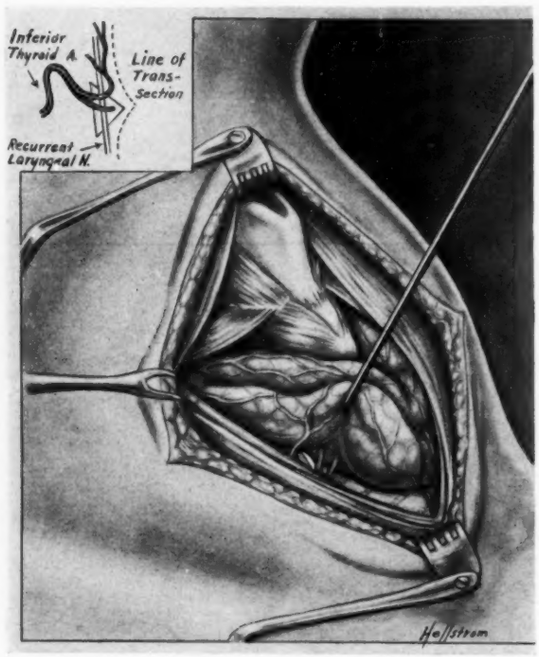

FIG. 1. Anatomical drawing made at time of operation showing trianguloid depression to be avoided.

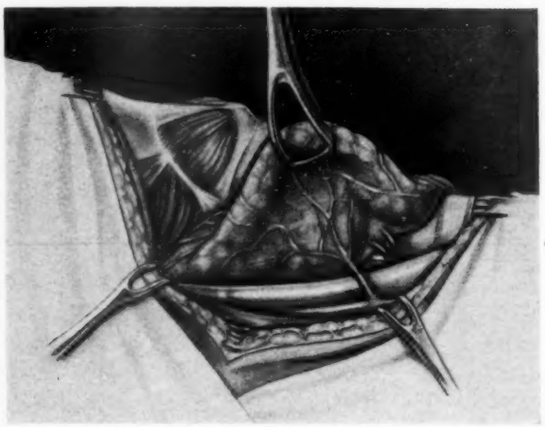

FIG. 2. Trianguloid depression shown after gland is elevated, prior to removal.

Obviously, the anatomic relationships and peculiarities of the recurrent laryngeal nerve are of decisive importance in the working out of a safe and practical operative procedure. A review of the literature discloses different descriptions of the course as well as the structure of the nerve. According to some authors the nerve lies directly in the tracheo-esophageal groove while others state that it lies in a lateral position. It has been found, however, that as a rule the location of the recurrent laryngeal nerve is quite constant and is almost invariably independent of the size and type of goiter or its depth in the chest.

On the right side the nerve takes rise in front of the subclavian artery and loops from in front backward around this vessel to proceed obliquely upward to the side of the trachea behind the common carotid artery. It extends along the groove of the trachea and esophagus and lies adjacent to the posterior capsule of the gland. On the left side the nerve takes rise on the left of the aortic arch, winds below the aorta and at the point of attachment of the ligamentum arteriosum turns obliquely upward to proceed to the tracheo-esophageal groove. The nerve on each side ascends along this groove and passes under the lower border of the constrictor pharyngis inferior to enter the larynx behind the articulation of the inferior horn of the thyroid cartilage.

Variations are encountered regarding the position which the recurrent laryngeal nerve has in relation to the inferior thyroid artery.

Berlin and Lahey[1] noted that in twenty-two dissections the nerve on the right side was anterior to the artery in eighteen cases and posterior on the left side in nineteen cases. Fowler and Hanson[5] reported that in 65.5 per cent of 200 dissections the nerve was posterior to the artery, anterior in 26 per cent and lay between in 8.5 per cent. In the forty-two dissections of Ziegelman[13] the nerve was anterior in seventeen instances, posterior in twelve and lay between in thirteen. The findings of Weeks and Hinton[12] essentially corresponded with those of Ziegelman.

The relation of the recurrent laryngeal nerve with the inferior thyroid artery is an outstanding consideration in thyroid surgery. It is well known that the nerve is most vulnerable when it lies in close proximity to this artery. Here then is the great danger area. In our experience injury most frequently occurs when attempts are made to control hemorrhage. The upper branches of the inferior thyroid artery approach the

trachea to enter the gland; at this site they may be cut or torn across during thyroidectomy. When the bleeding points retract, the hemostat used in their attempted control may include and traumatize the recurrent laryngeal nerve.

Although compressing the carotid artery will permit control of hemorrhage from the superior thyroid, it will not control bleeding from the branches of the inferior thyroid artery, a branch of the thyrocervical trunk. The operation may be excessively prolonged by delay in control of hemorrhage from the branches of the inferior thyroid and the anatomic relationships will be obscured. The surgeon is familiar with the intimate relationships of this artery to the parathyroids and trachea as well as the recurrent laryngeal nerve. The danger of injury to these structures is indeed great and obvious in the event that attempts are made to control hemorrhage by direct clamping or suture of the bleeding points.

We have devised and extensively employed a modification of the usual procedure on the placing of these clamps. (Fig. 1 and 2). To make doubly sure that the clamps in every instance bite into thyroid tissue as we reach the trianguloid depression at the site where the inferior thyroid artery branches to enter the gland, we place the clamp around and slightly but definitely beyond the rim of this depression. This refinement in technic greatly aids in reducing to a minimum the risk of damage to the recurrent nerve. (Fig. 3.)

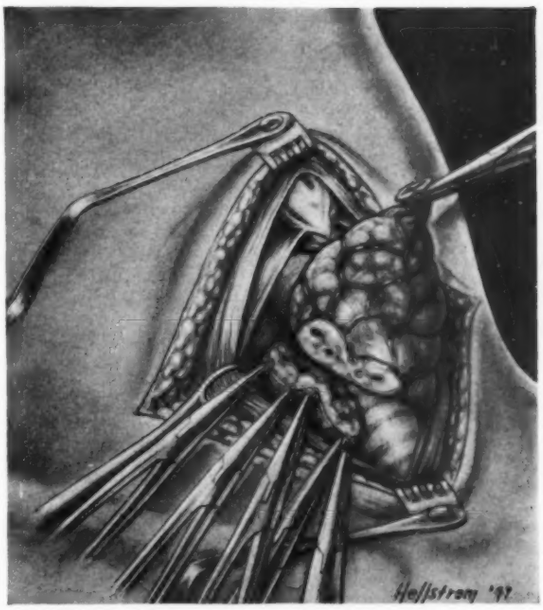

FIG. 3. Incision made through the gland avoiding the triangle.

SUMMARY

1. In the past injury to the recurrent laryngeal nerves has been of much concern to the thyroid surgeon. Many technics have been improvised to prevent injury to the nerves but too often these methods complicate or prolong the operation unnecessarily.

2. In our experience injury usually occurs when attempts are made to control hemorrhage. It is well known that the nerve is most vulnerable where it lies in close proximity to the inferior thyroid artery. This is the danger area.

3. At this point a triangular depression is seen when the lobe of the gland is elevated. This depression might be called an artefact because it is not an anatomic depression but a surgical one. It is this depression which must be avoided.

4. The technic presented, we believe, not only avoids injury to the nerves but also simplifies thyroidectomy in such a way as to make hemorrhage a rarity.

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Most commonly, cancer of the vulva means an epithelioma of the labia, perineum or vestibule. However, other tumors are also included under this heading such as a melanosarcoma or carcinoma of one of Bartholin's glands or of the glans clitoris. Often only a local excision is done and later enlarged lymph nodes in one or both groins may be removed. Such haphazard surgery, however, is not followed with a high percentage of successful results. Recently, therefore, several clinics have advocated practice of a one-stage radical vulvectomy (usually under local anesthesia in elderly and enfeebled women) in which the whole vulva and all the inguinal and femoral lymph nodes on each side are removed in one massive dissection. Results have been excellent, over one-half of these patients, even though advanced at time of operation, surviving and being apparently free of cancer five years after this radical operation. Lack of serious and frequent postoperative complications is credited to the use of local anesthesia. Hospital mortality was only 6 per cent. (*Richard A. Leonardo, M.D.*)

GLEANINGS AND TECHNICAL DETAILS FROM 500 VAGINAL HYSTERECTOMIES FOR PROLAPSE

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THE contents of this article are based on whatever of practical woeth has been gleaned by the author in performing 500 vaginal hysterectomies for prolapse during the past twenty-five years, and on a careful analysis of the bulky literature dealing with the various phases of this subject. Indeed, the earliest contribution to deal with this entity was that of the able southern surgeon, Samuel Choppin[1] of Eaton Rouge, Louisiana. Though his original article appeared in 1867, he had performed the first vaginal hysterectomy for prolapse on January 12, 1861, at New Orleans, at a time when P. C. Huguier,[2] the eminent gynecologist of Paris, was praying *le bon Dieu* to preserve him from ever resorting to this procedure, preferring instead high amputation of the cervix. Paranthetically, it may be stated in passing, that within a period of fifty years during the last century three pioneer southern surgeons had in a measure revolutionized gynecological surgery: McDowell removed an ovarian cyst in Danville, Kentucky (1809); Sims perfected a technic for the repair of vesicovaginal fistula in Montgomery, Alabama (1852); and Choppin resorted to a vaginal hysterectomy for prolapse in New Orleans (1861).

In the present series, which includes cases from private practice and from the author's gynecological service of City Hospital, but one death occurred and that of an undiscoverable cause. Three patients developed a postoperative pelvic abscess necessitating puncture and drainage; postoperative hemorrhage occurred on several occasions, all manageable with vaginal packing and a transfusion or transfusions. Urinary infections rarely developed even in instances of pronounced and long-standing cystoceles. Further, it must be stated, although the action is not condoned, that not one of these patients in this series was submitted to any preoperative urologic study.

The common designations for this entity are prolapse and procidentia—terms used interchangeably on occasion. The author deems it preferable, however, to apply the term prolapse to cases in which the descending part is limited to the elongated cervix with or without a cystocele. The descent may be of the first, second or third degree, depending upon the location of the external cervical os, just above, at, or below the vaginal introitus. But this detailed classification, however, is an arbitrary one, for invariably the cervix may be easily pulled to increase its descent to an appreciable amount. The above type (prolapse of the elongated cervix) constitutes the largest number of cases. The term procidentia is reserved for the rare case in which the vagina is completely everted and the entire genital tract, i.e., the vagina, cervix and fundus, lies a globular mass outside the vulva.

Without any repetitious excursion into a discussion of the accepted causes of prolapse—some of which are either of doubtful worth or highly improbable, such as the weight of the uterus, subinvolution, initial retrodisplacement, increased intra-abdominal pressure, rents and relaxations of the "pelvic fascia," atrophy of the muscular, fibrous, elastic and fatty tissues—it may be safely stated that prolapse occurs as the result of an obstetrical injury; and to be more specific, it results from a general attenuation and relaxation of the fibroelastic fibers of the vaginal wall and in a lesser degree from an attenuation of the

lower portion of the cardinal ligaments. With this trauma to the individual fiber, the necessary resiliency and tonicity are eventually lost. But what is clearly unexplainable is the cause of the cervical elongation. In procidentia, in addition to the injury (loss of resiliency and tonicity) to the structural elements of the lateral supports of the vagina, the entire cardinal ligaments are involved. Here the ligaments have lost their tonicity completely and are markedly elongated and useless for reconstructive purposes. It is well to abandon the idea that a prolapse, or even cystocele for that matter, is a hernia. The basic concept of a hernia involves an opening or a rent, a sac and contents (of the sac). No such findings exist in either prolapse or cystocele. The anterior vaginal wall has two fixed points, one to the urethra and, consequently, to the public arch, and the other to the tip of the cervix; between these two fixed points, as the result of an injury to the resiliency and tone of the individual fibers of the anterior vaginal wall, *sacculation* occurs and consequently a cystocele. In procidentia the fibers of the cardinal ligament inserted in the upper vaginal wall and cervico-fundal area have stretched beyond resiliency and the vaginal walls have caved in. With extreme rarity, prolapse and even procidentia in the nullipara and even in the virgin may occur, and in these instances the lesion is due to some grave congenital structural deformity of the genital cleft and the lower Müllerian system.

The prevailing present day surgical procedures for prolapse and procidentia are vaginal hysterectomy, the so-called "Manchester operation," the Spalding-Richardson composite technic, the interposition, the Le Fort, colpectomy and the utero-abdominal fixation. All these procedures have their corps of devotees. But the author singles out the interposition operation as the one procedure which should be completely abandoned if for no reason other than that it is a decidedly unanatomical reconstruction. Further, it may prevent the recurrence of cystocele but not prolapse and at the price of a grave anatomic derangement. In resorting to a utero-abdominal fixation, the operator is admitting failure in his plastic principles. In the surgical management of prolapse, all the above procedures have been abandoned by the author save two—vaginal hysterectomy and the high amputation of the cervix. For the occasional case of procidentia, the author resorts to his own type of colpectomy which will be described in a subsequent article.

All patients to be subjected to a vaginal plastic operation for prolapse or procidentia are given several preoperative days of hospital bed rest during which time the vagina is packed daily with well saturated boro-glycerin tampons. This step is considered of utmost importance since it relieves local congestion and edema of the prolapsed parts; it has a definite tendency to reduce operative bleeding and makes for better healing and better end results. In the aged patient estrogens are administered during the preoperative week with the hope of increasing the circulation of the senile genital parts. In the surgical management of prolapse two factors of prime importance stand out as reconstructive guides: the degree of the descent and the age of the patient. In the selection of the type of operation and in the execution of the technic the operator must aim for a permanent abolition of the symptomatology; and whenever possible he must restore the regional configuration and re-establish the perineo-vulvo-vaginal anatomy and physiology; the perineum must be resilient, the vaginal introitus of a proper expansile circumference and the vagina of adequate depth. This *optimum* cannot be obtained in cases of procidentia; for the most part this is a disease of the aged.

For the management of prolapse occurring in the patient of the menstrual age, a high amputation of the cervix with vaginal sterilization is deemed most suitable. Sterilization is a requisite, since pregnancy in instances of high cervical amputation frequently ends in a miscarriage with severe

abortal or postabortal hemorrhage. Amputation of the elongated prolapsed cervix was first suggested and performed independently by P. C. Huguier and F. Rizzoli[3] between 1850–1860. The suturing of the vaginal cuff to the stump following cervical amputation was first performed by J. Marion Sims[4] in 1856. In 1888 at Manchester, England, A. Donald[5] perfected his technic in amputation of the cervix for prolapse. It must be understood that following vaginal removal of the uterus, repair of the anterior, posterior vaginal wall and the perineum must also be performed. Frills such as variations in parametrial fixations are considered inconsequential and unnecessary by the author. For the patient in the postmenopausal state with a prolapse of the elongated cervix, a vaginal hysterectomy is the method of choice.

Vaginal plastic surgery is reconstructive surgery, demanding neatness, accuracy and symmetry in its execution. No reconstruction of the genital parts is possible without an initial "destructive" operative phase. This entails incising and excising of tissues, exposing and displacing of organs, and it is in the execution of this phase of plastic surgery that serious blood loss may occur unless the natural cleavage planes are utilized. Appropriate position of the patient is essential; the buttocks should project outward sufficiently to permit a weighted speculum to hang unobstructed by the table. The pudenda and the vagina should be thoroughly washed with soap and daubed with alcohol. The sterile drapery must be so arranged as to remain securely in place throughout the operation. Suitable instruments are extremely essential for both accurate and delicate reconstruction, particularly a set of Sims specula, Deaver's vaginal retractors, two small (Jackson) tenacula and about a dozen Allis clamps. The author has repeatedly seen in various hospitals the instrument table set for a vaginal plastic operation encumbered with every instrument ever devised and in the possession of the particular institution. All this accumulation of metal is unnecessary. Suturing of the labia if excessively pendulous will add to proper exposure. The comfort of both the surgeon and his assistants is essential since vaginal plastic procedures are tedious and frequently extend into the second operative hour. Precision in minor details adds to better end results. Each assistant must be schooled in his appointed task. Above all, the vaginal walls are not to be split by the introduction of an "insinuating" or "tunnelling" scissors to create false planes and such artefacts as bladder pillars and pubovesical fascias. A gauzed finger is not to be used to displace the bladder or rectum since it produces a general ooze; nor is a sound to be introduced in the bladder to locate its lowermost wall for it is misleading. Finally, it may be added that a bloody operative field, strewn with bits of tissue, cluttered with useless clamps and littered with dangling unnecessary sutures displays surgical clumsiness, leads to confusion and prolongs operative time.

In performing a vaginal hysterectomy for prolapse, the following sequential steps (based on the Bissell-Goff principles) have been found to facilitate surgery, shorten operative time, reduce the amount of bleeding to a minimum and clarify an apparently difficult procedure to a point of simplification:

A. "Destructive" phase for the vaginal removal of uterus:

1. Transverse incision of the anterior vaginal wall from its cervical union and exposure of the anterior avascular areolar space; median incision of this wall ending at the vesico-urethral junction.

2. Displacement of the bladder from the vaginal wall and from anterior cervico-fundal surface.

3. Exposure and penetration of the vesico-uterine peritoneal fold.

4. Delivery of the fundus through the peritoneal "window" by traction and flexion.

5. Liberation of the fundus from its lateral attachments: the tubes, ovarian

ligament, round and broad ligaments, down to the uterosacral ligaments.

6. Suture of the uterine vessels.

7. Incision of the posterior vaginal wall from its cervical union and exposure of the avascular areolar space.

8. Lateral incision of the vaginal wall to complete the liberation of the vaginal fusion with the cervix.

9. Exposure and liberation of the cardinal ligaments from the cervicofundal attachment.

B. Reconstructive phase (anterior vaginal wall):

1. Union of cardinal ligaments.

2. Suture of uterosacral ligaments and narrowing of cul-de-sac.

3. Excision of redundant anterior vaginal wall and repair.

4. Suture of cardinal ligament to vaginal wall.

TECHNIC*

1. The anterior vaginal wall is placed on tension by applying traction to the cervix pulling the organ outward and downward. This is best done by grasping each lip exactly in midline with a short (Jackson) tenaculum, everting the intracervical tissue. That part of the anterior vaginal wall above the point of fusion with the cervix is gently rolled between the index finger and thumb several times. The wall is then massaged upward toward the urethra with vigorous "swings" of the thumb. These initial steps are not essential although their habitual use has convinced the author that the planes of separation thereby become more apparent. On close inspection it is possible to note where the fusion between the vaginal wall and the cervix ends and the avascular space begins. The fused portion of the vaginal wall is smooth and lacking in rugae. At this point, which is usually about ¾ inch above the external orifice of the cervix, the vaginal wall is grasped with Allis clamp. As a matter of fact, the clamp grasps the reduplicated layers of the entire thickness of the vaginal wall. Another Allis clamp is placed ¼ inch above this first clamp. Between these two the entire thickness of the vaginal wall is incised with a curved scissors, the tip of the scissors pointing perpendicular to the cervix. If this incision is made at the correct level, an avascular clear space or pocket-like compartment appears, bringing into view the bladder bulge and a few shreds of areolar fibers. It is essential to incise the entire thickness of the vaginal wall and to enter the proper cleavage area. By so doing such artefacts as pillars of the bladder, pubocervical ligaments, pubocervical fascia and uterovesical ligaments will not be "created" to plague the operator. If the bladder musculature is not visible and if the index finger does not displace the bladder instantly at the slightest pressure, the operator has incised too close to the cervix and has missed the avascular space. To gain the space from this point it is best to grasp the cut surface of the vaginal wall at both ends of the incision with Allis clamps. These instruments are held taut and parallel with the floor. With a straight scissors the presenting vaginal wall is incised upward exactly in midline. This procedure will lead the operator into the avascular areolar cleavage space. The incision is then continued up to the urethrovaginal junction where the cleavage plane ends. To go beyond this wall may injure the sphincteric urinary control.

2. The wall of the bladder is displaced with index finger from both flaps of the incised vaginal wall and from the cervicofundal surface, exposing the vesico-uterine peritoneal fold. When the bladder appears adherent to the vaginal wall, it is best to incise the adherent areas following the proper cleavage plane. The peritoneal fold is best demonstrated by applying traction on the cervix and by elevating the bladder with a Deaver vaginal retractor. Once identified by noting its transparency, the peritoneum is incised and with the index finger the pelvis is explored, delineating the size of the fundus, its contour, mobility and at the same time the "state" of the adnexa.

* See Figures 1 to 5 showing complete technic.

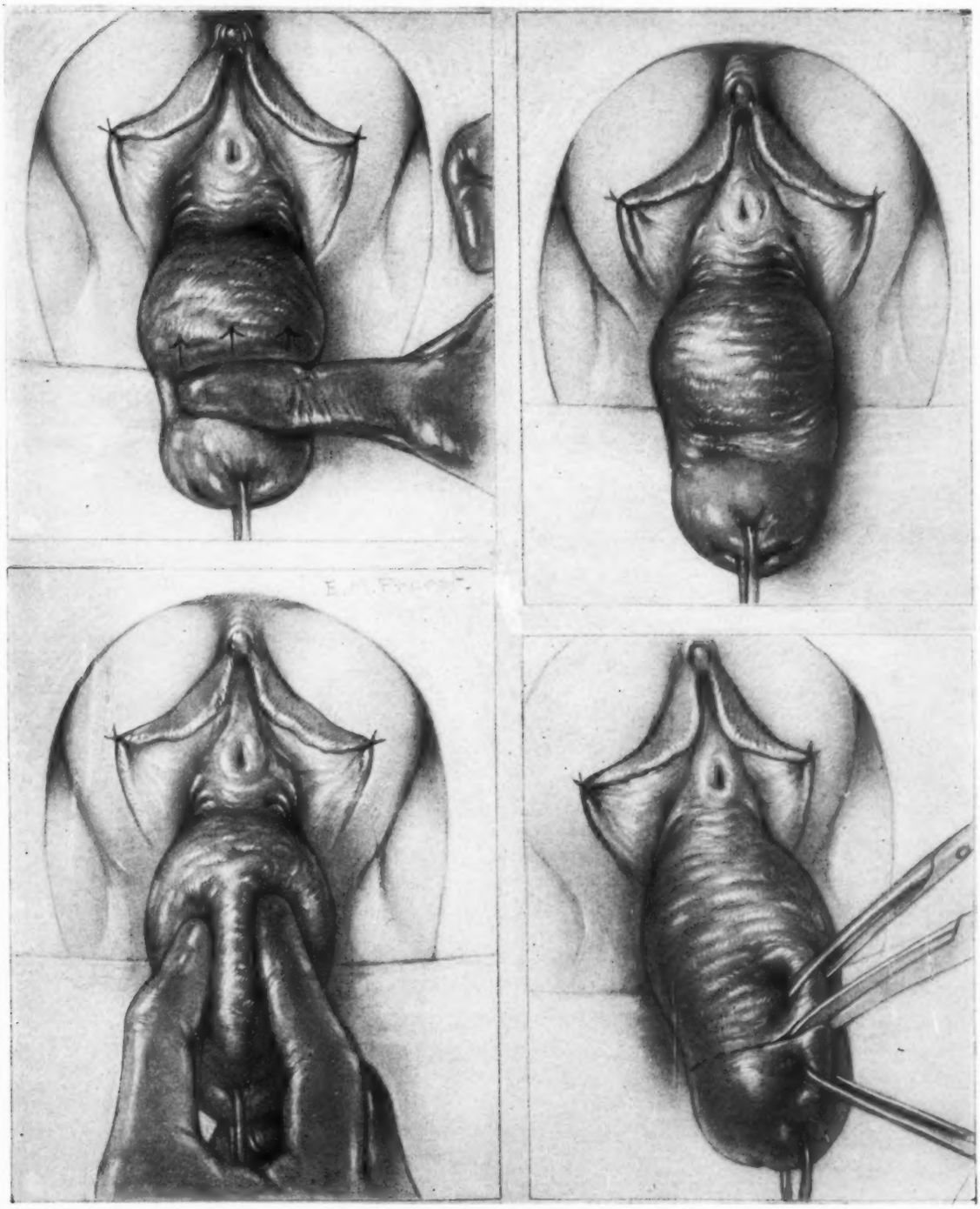

FIG. 1

3. The fundus is grasped and delivered; this is best done by the use of two or three sutures biting into the substance of the fundus exactly in midline. The "bite" must be deep enough to avoid tearing. These sutures climb one above the other, ladder-like about ½ inch apart until the dome of the fundus is reached. Pulling the topmost suture outward and exerting counterpressure by pushing the cervix into the

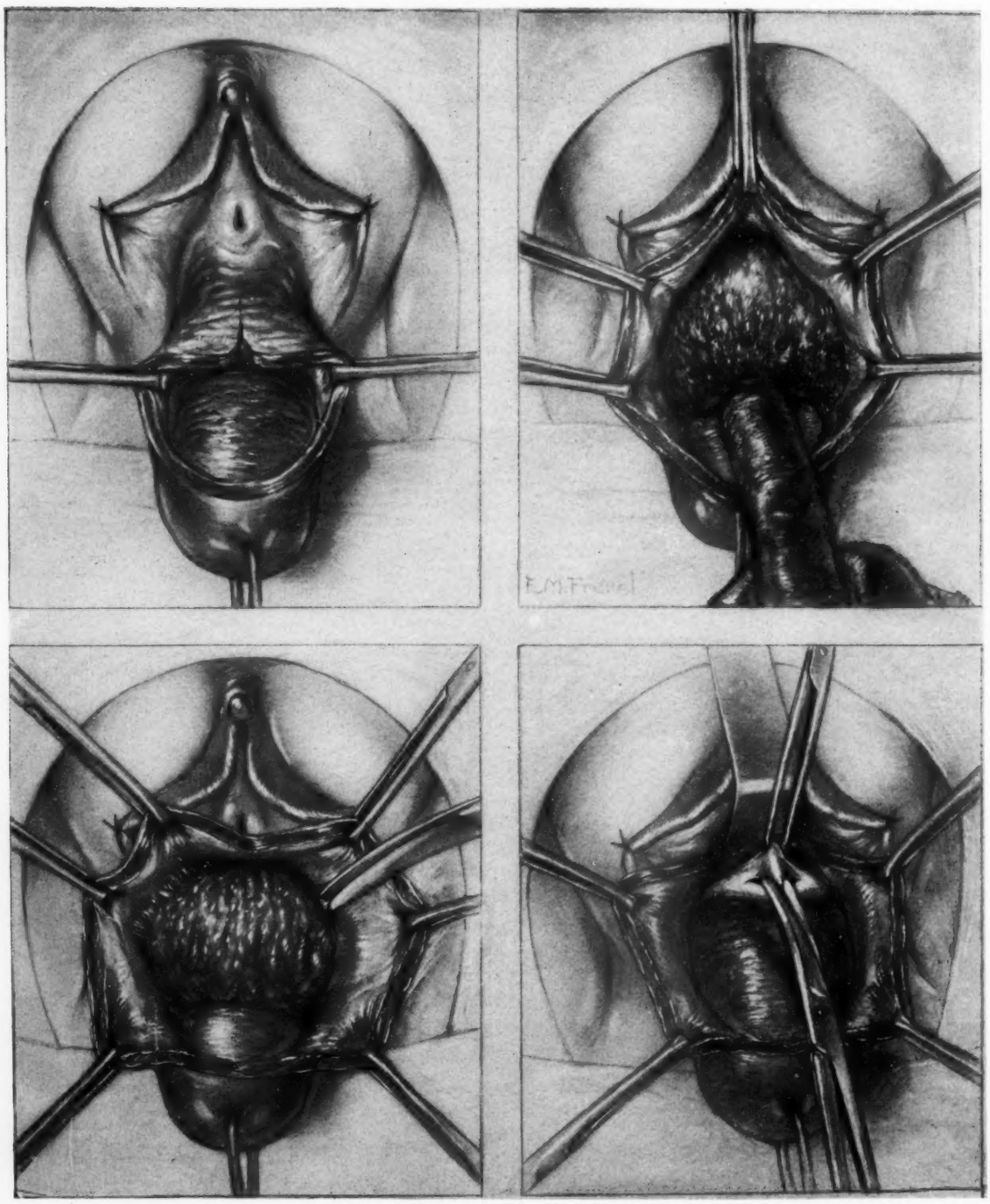

FIG. 2

sacral hollow facilitates the delivery of the fundus.

4. The fundus is now pulled to one side while a Deaver retractor exerts pressure in the opposite direction and this procedure exposes the uterine insertion of the tube, round ligament and utero-ovarian ligament. These three structures are clamped with two curved Kelly instruments; the tissue between is incised and the lateral stump tied. This stump is permitted to retract since it is not used in any recon-

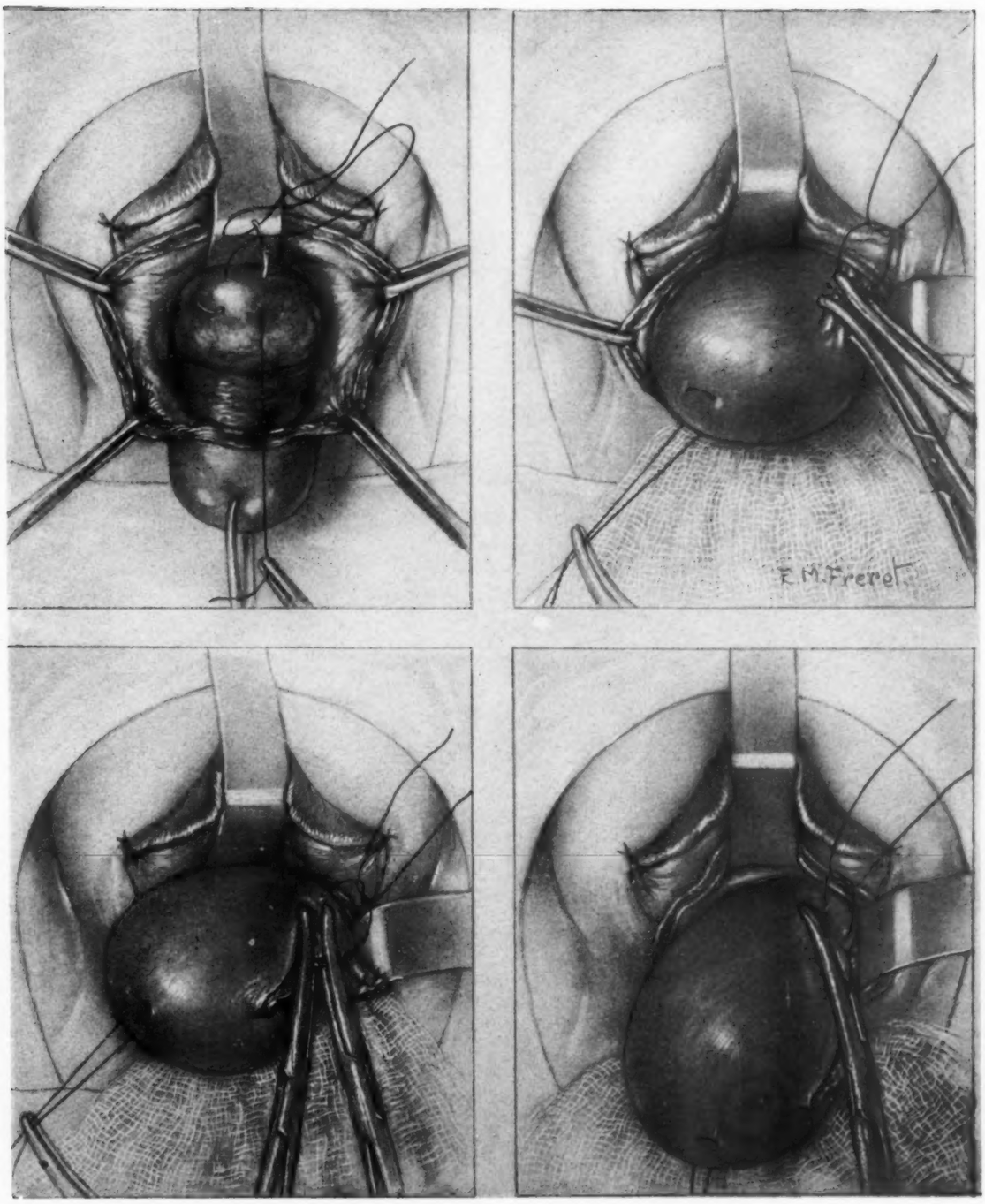

FIG. 3

struction step. The next suture is placed in the leaves of the broad ligament after an incision separates it from its uterine attachment. Here, invariably the uterine vessels appear and these are firmly clamped, cut and sutured. With the completion of this step, the uterosacrals come clearly into view, particularly if traction of the uterus is increased. These steps are repeated on the opposite sides; this completes the surgery in this area.

5. The posterior lip of the cervix, held

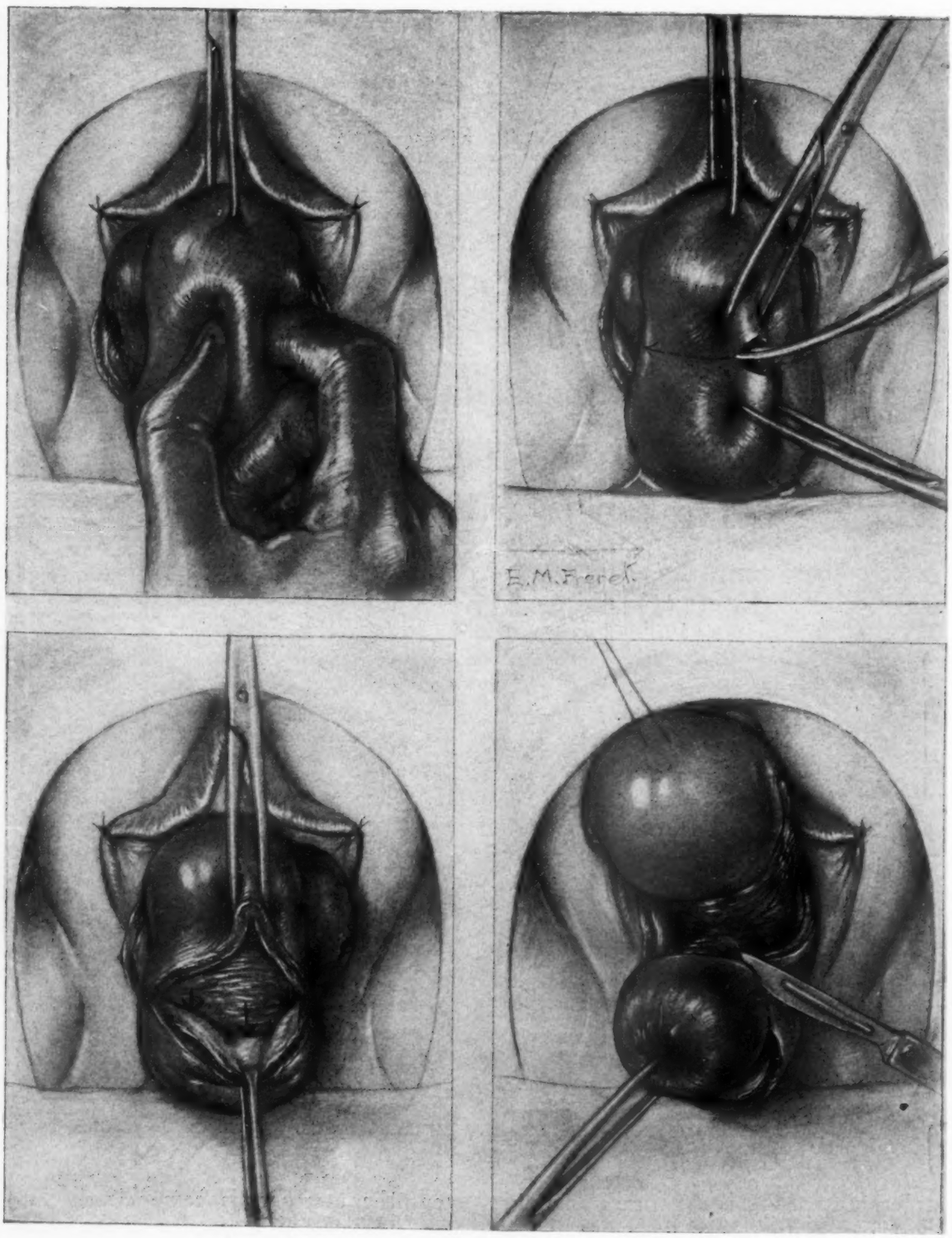

FIG. 4

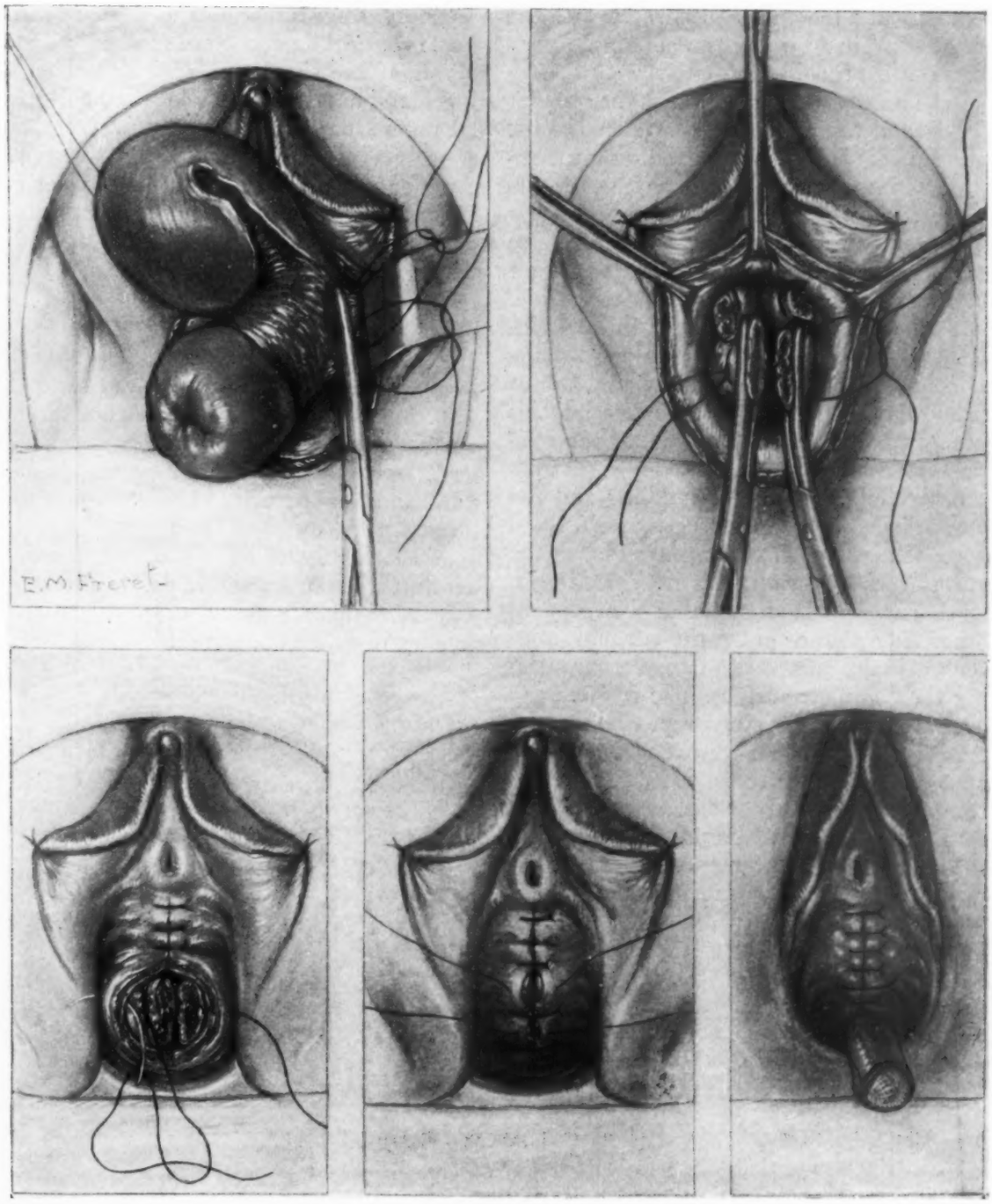

FIG. 5

with a Jackson tenaculum, is pulled upward placing the posterior vaginal wall on tension. Just below the point of fusion of this wall with the cervix, an indentation (dimple) is noticeable; it marks the end of the fusion area and the beginning of the avascular space. The vaginal wall is here grasped with two Allis clamps, about ¼ inch apart and the wall between them is cut transversely. This incision leads into the areolar cleavage space. Here the areolar mesh is thicker than that anteriorly, but it

is easily and bloodlessly separated with the finger and in so doing the cul-de-sac peritoneum is brought into view.

6. The operator now exposes the remaining lateral vaginal wall still attached to the cervix; this is incised by extending the incision from the apex of the anterior transverse incision to the apex of the posterior transverse incision. Here the transverse cervical ligament begins to appear. These steps are repeated on the opposite side. This ligament is now grasped *in toto* with either a straight or curved clamp; cutting it completes the separation of the fundus from all its attachments. By repeating this procedure on the opposite side the uterus is removed. The stumps of these ligaments are tied to each other in midline and the suture is held for further use.

7. The operator now returns to the anterior vaginal wall; this is grasped with an Allis clamp at the apex of the incision; other Allis clamps grasp the cut margin of the vaginal wall and are fanned out exposing the complete surface. The redundancy is excised and the steps repeated on the opposite side. These fresh edges are now approximated by interrupted sutures. This completes the closure of the anterior vaginal wall. Here follow two important steps, the suturing together of the uterosacral ligament and the cul-de-sac peritoneum and secondly the stump of the united transverse cervical ligament are sutured to both layers of the shortened vaginal wall. The former eliminates a possible enterocele; the latter pulls the vaginal wall upward, creates a vagina of normal depth and prevents eversion of that organ. A drain is inserted at this point. No retention catheter has ever been used and no bladder injury produced in this series of cases.

CONCLUSIONS

1. A technic is presented which has been evolved performing 500 vaginal hysterectomies for prolapse. The steps of the operation as herewith minutely described have been found to simplify the procedure, shorten operative time and minimize bleeding.

2. In this series of 500 operations one death, three postoperative pelvic abscesses and a minimal amount of postoperative urinary infections occurred.

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JAUNDICE*

ITS OCCURRENCE AND SIGNIFICANCE

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IN the light of the increased knowledge of the physiology of the liver and reticulo-endothelial system, the symptom jaundice, icterus or hyperbilirubinemia may be defined as the condition in which the bilirubin level in the blood serum is abnormally high. It signifies the visible yellowish discoloration of the scleras, skin and mucous membranes which occurs when the pigment bilirubin rises in the blood above a certain level. The discoloration may be a faint lemon tinge observable only in the sclera or it may go on to a deep yellow pigmentation of the skin. Bilirubin appears in the urine and sweat but does not pass into the saliva or milk nor as a rule into the cerebrospinal fluid. The clinical appearance of jaundice depends on the amount of bilirubin circulating in the blood stream. In recent years increasing attention has been focused on laboratory data as a guide for diagnostic and therapeutic help; and although a wealth of knowledge has been accumulating by the work of many investigators on hepatobiliary diseases, yet a considerable number of patients with jaundice still present a baffling problem in differential diagnosis.

Jaundice may be a manifestation of the formation of large amounts of bilirubin through excessive disintegration of red blood cells (such as is observed in hemolytic anemias) beyond the capacity of the liver cells to filter it out of the blood or it may be a sign of a disturbed liver function in which the liver cells are diseased or injured by toxic agents and their capacity to remove even a normal amount of bilirubin from the blood is diminished. In some patients these two causes are jointly or successively responsible for the jaundice and yet there are many extrinsic factors that play a serious part in the production of jaundice. Each patient presents a problem of his own. The surgeon is called upon to evaluate all the facts, to determine whether the condition is surgical or medical and to offer either a good or poor prognosis. This would imply that a careful history and a diligent physical examination supported with laboratory data are of primary importance. With adequate interpretation of signs and symptoms many exploratory laparotomies can be avoided in cases of hepatitis and the patient can be best guarded from the harmful effects of a delayed operation in cases of extrahepatic obstruction.

Physiologic Consideration. Bile in most animals and in man is continuously secreted by the liver cells. It passes along the bile capillaries and hepatic and cystic ducts to be stored in the gallbladder or pass into the duodenum. Bile is a highly complex fluid whose chief components are bile salts, bile pigments, cholesterol and lecithin. These organic materials make up over 60 per cent of the total biliary solids. As a result of the absorption of water and inorganic salts, gallbladder bile is several times more concentrated in inorganic solids than liver bile. The biliary pigments are bilirubin and biliverdin. Bilirubin is the chief pigment component of human bile and in the bile of the Carnivora. Biliverdin is an oxidative derivative of bilirubin and is present only in small amounts in human bile but is the chief pigment of birds' bile. The pigments constitute from 15 to 20 per cent of the total solids in liver bile. These

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bile pigments are produced by the destruction of red cells. About 25 Gm. of hemoglobin are liberated daily as a result of normal erythrocyte destruction. Approximately 15 to 20 Gm. are utilized in the production of new red blood cells and 5 to 9 Gm. undergo degradation to bilirubin. The liver normally excretes 200 to 370 mg. of bilirubin daily in the bile, representing 4 per cent by weight of the hemoglobin from which it is derived.

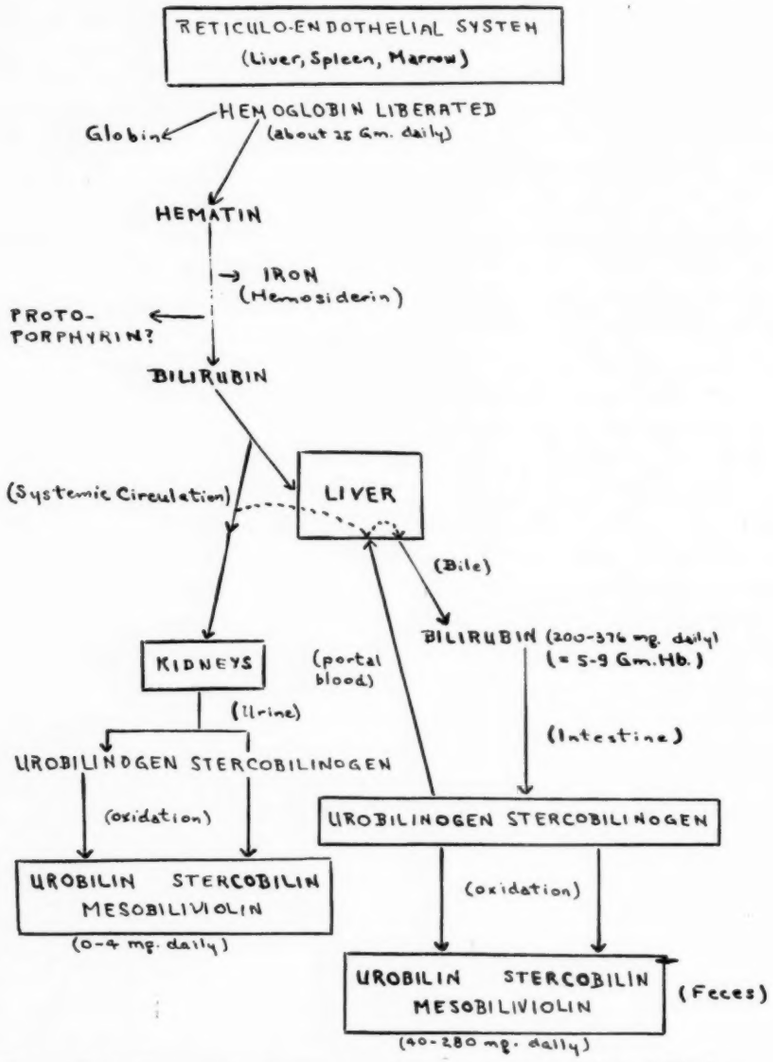

FIG. 1. From CANTAROW, ABRAHAM and TRUMPER, MAX. Clinical Biochemistry. 3rd ed., p. 431. Philadelphia, 1947. W. B. Saunders Co.

Pigment Metabolism. The reticulo-endothelial system, namely, the bone marrow largely, the spleen, some lymphatic glands and the Kupffer cells of the liver and tissues, is involved in the metabolism and formation of bile pigments. The hypothesis that the hepatic polygonal cells play a part in the production of bilirubin has not been abandoned. It is now generally accepted that their chief function is to remove bilirubin from the blood and excrete it into the bile. So far as is known the chemical changes involved take place in three sites, viz., the reticulo-endothelial system, the liver and the colon. (Fig. 1.)

Bilirubin is derived from hemoglobin of disintegrated red blood cells by a process of

hydrolysis. It is changed in the colon by the action of bacteria to urobilinogen which is a colorless compound having the structural formula like that of bilirubin except for the addition of hydrogen atoms. A portion of urobilinogen is excreted in the feces and is converted to urobilin by oxidation. Urobilin is an orange-yellow pigment which is partly responsible for the color of normal stools. The unexcreted urobilinogen is reabsorbed and carried by the portal circulation to the liver. In the liver the major portion of the reabsorbed urobilinogen is excreted into the bile and any which escapes into the systemic circulation is excreted by the kidneys. The urobilinogen in the urine upon exposure is oxidized to urobilin. Normally the urine contains none or traces of urobilin (0.5 to 2 mg.). The exact manner in which old or injured red cells are destroyed by the reticulo-endothelial system is not yet clearly understood. The current concept is that the porphyrin ring of the liberated hemoglobin is broken at the alpha-methene bridge, the iron is removed and the resulting iron-free compound is probably bilirubinglobin.

According to Watson globin is a protein of about the same molecular weight as albumin. It is attached to the pyrrole nuclei by carboxyl groups as in the hemoglobin molecule. Bilirubinglobin, an iron-free compound, is transported in the blood to the liver where the polygonal cells separate bilirubin from globin and excrete it into the bile as sodium bilirubinate which must be considered a loosely connected compound because the bacterial flora of the colon changes it into urobilinogen. Actually, two urobilinogens (mesobilirubinogen and stercobilinogen) are formed in the intestines. It is best to refer to them collectively as urobilinogen since the chemical tests for their quantitative measurements consider them as if they were a single compound. The current literature does not make it clear as to whether the reabsorbed urobilinogen is transformed again by the liver cells into sodium bilirubinate. It must be concluded, then, that the major portion of the reabsorbed urobilinogen is removed from the portal blood by the hepatic cells and is perhaps converted into bilirubin or a hypothetical pigment complex. There is some question as to whether any bilirubin is absorbed from the intestines; none is present normally in the feces. Inasmuch as the molecular weights of urobilinogen and urobilin are approximately the same as that of bilirubin, all being about 4 per cent of hemoglobin, the approximate hemoglobin wastage may be determined indirectly by determining the quantity of these pigments excreted in the urine and feces. Bile acids, perhaps the most characteristic constituent of bile, occur in human bile chiefly as salts of the cholic and desoxycholic acid series and their derivatives. They are specific products of the hepatic cell activity and occur in human bile chiefly as conjugated amino acids being combined with glycine and taurine. They are chiefly found in the form of salts of one of the alkalis, chiefly sodium. Experimentally it has been observed that following the administration of hepatotoxic agents and prolonged periods of total bile stasis a decrease in the bile has been observed in clinical states of extensive hepatic damage.

From the amount of bile pigments excreted daily by the liver one can readily see that a large amount of hemoglobin is liberated from the disintegrated red blood cells in twenty-four hours. It has been estimated that in health about 10 million red cells are destroyed every second and, of course, the same number must be formed anew by the blood-forming tissues. The loss of hemoglobin is about 25 Gm. daily. The life of the average red cell is 80 to 120 days. Any condition which leads to increased destruction of red cells causes a greater production of bile pigment. The site of bilirubin formation has been a subject of controversy for many years. Formally it was thought that the liver was solely responsible for the formation of bile pigment. Today it has been proven conclusively that in mammals the tissues, viz.,

the histiocytes or reticulo-endothelial cells other than the liver have the ability to produce bile pigment. This observation which is now universally accepted has been substantiated by such investigators as Mann, Bollman and Magath. These observers removed the liver completely from dogs. The animal survived twenty-four hours or more and bilirubin began to appear in the blood from three to six hours after the operation and gradually increased in amount up to the time of death. Virchow observed that in old, extravasated blood clots found in remote locations from the liver formed a pigment, hematoidin, having the chemical properties of bilirubin. According to Rich, "Blood destruction alone is not capable of producing jaundice except perhaps in rare instances when the hemolytic process is of extreme degree."

RETICULO-ENDOTHELIAL SYSTEM
Reticulo-endothelial Cells or Histiocytes

I Fixed Histiocytes				II Wandering Histiocytes		
1	2	3	4			
Connective Tissues	Reticular	Endothelial	Microglia	Solid Tissues	Blood Histiocytes	
(Resting wandering) cells	In reticulum of spleen, lymph glands, bone marrow	Lining sinuses or capillaries of liver (Kupffer cells) spleen, bone marrow adrenal, pituitary			(a) Of extraneous origin	(b) Monocytes

Hyperbilirubinemia. According to Barron the concentration of bilirubin in the blood plasma depends upon (1) the amount of hemoglobin liberated (number and rate of destruction of erythrocytes), (2) bilirubin formation (functional activity of the reticulo-endothelial cells, (3) removal of the bilirubin from the blood (hepatic polygonal cell function), (4) normal bile flow (patency of the bile canaliculi and bile ducts) and (5) structural integrity of the hepatic cell lining of the bile canaliculi.

Normally the bilirubin formed from the destruction of red cells is excreted by the polygonal cells into the bile. If these cells are damaged by disease or toxic agents, jaundice will result because of the inability of these cells to excrete it into the bile. If the biliary tree is clear, bile will reach the duodenum. If any portion of the biliary tract is obstructed, the bile will accumulate proximal to the obstruction. As a result there will be increased pressure in the biliary radicles and bile leaks into the blood spaces, enters the circulation and causes clinical jaundice.

Serum Bilirubin Determination. Serum bilirubin concentrations above 0.5 mg. per 100 cc. or icterus index above six units constitutes a state of hyperbilirubinemia. The degree of hyperbilirubinemia necessary for the production of clinical icterus varies in different types of jaundice. It has long been recognized that discoloration of the scleras and skin and passage of bile pigment into the urine occur more commonly in obstructive and hepatocellular than in hemolytic jaundice. This has been explained on the basis of the hypothesis that in obstructive jaundice the bilirubin is more readily diffusible (direct-reacting bilirubin) than in hemolytic jaundice (non-direct-reacting bilirubin). It has been found that in obstructive and hepatocellu-

lar jaundice, when an icterus index value of 16 or a serum bilirubin concentration of 1.6 mg. per 100 cc. is reached and persists for some days, bilirubin diffuses through the capillaries and appears in the tissues and urine. Greater concentrations are usually necessary in hemolytic jaundice for the production of frank icterus. Some observers believe that at times bilirubin leaves the blood for the tissues at a lower concentration than the threshold for elimination in the urine. The indirect van den Bergh test requires the addition of alcohol to the Ehrlich's diazo reagent. The direct mixture of serum and reagent in aqueous acid solution constitutes the direct van den Bergh. The bilirubin of bile gives both direct and indirect reactions. As it has been pointed out, the bilirubin from destroyed erythrocytes is normally excreted by the hepatic polygonal cells into the bile. The pigment prior to the excretion by these cells produces an indirect reaction whereas after it has gone through the liver cells it produces a direct reaction. Apparently, then, when the pigment is filtered by these cells, it goes through some changes. According to Rich and Young bilirubin exists in the blood as bilirubinglobin which when filtered by the polygonal cells of the liver is converted into sodium bilirubinate and normally excreted in the bile as such. The altered bilirubinglobin molecule into sodium bilirubinate causes the difference in reaction. The presence of a positive direct reaction in the blood serum implies the presence of bilirubin that has re-entered the circulation after having passed out of the blood through the hepatic cells into the bile canaliculi, e.g., biliary obstruction or hepatocellular damage. Diminution in the amount of bilirubin in the blood may be observed in aplastic anemia and in all secondary anemias, particularly those associated with malignancy and chronic nephritis. A decrease may occur in the elevated serum bilirubin concentration of patients with carcinoma of the head of the pancreas even though complete obstruction to the flow of bile persists. This phenomenon is due to a decrease in the rate of formation of bilirubin as a result of decrease in the rate of destruction of red blood cells.

On the basis of the etiology of jaundice, I believe, McNee's classification offers a good working approach.

MCNEE'S CLASSIFICATION OF JAUNDICE

1. *Obstructive Jaundice.* Obstruction to flow of bile, usually confined to extrahepatic duct obstruction. Reflux of bilirubin from canaliculi into lymphatics or directly into blood due to increased pressure within or rupture of canaliculi. Positive direct van den Bergh reaction.

2. *Hepatocellular Jaundice.* Injury to liver cells. Decreased removal of bilirubin from the blood and, if severe damage, escape of bilirubin from canaliculi into blood, due to cell necrosis and disruption of continuity of canaliculi. Direct van den Bergh reaction positive after very early stage.

3. *Hemolytic Jaundice.* Excessive production of bilirubin. Negative direct van den Bergh reaction.

4. *Mixed Jaundice.* Usually starts as a biliary obstruction, but is followed by liver cell changes due to the prolongation and severity of the icterus.

In mixed types of jaundice the classification by Rich and Young offers a more useful working basis for the interpretation of jaundice due to retention and jaundice due to regurgitation.

CLASSIFICATION OF JAUNDICE AFTER RICH

1. *Retention Jaundice.* Overproduction of bilirubin and subnormal liver function. Negative direct van den Bergh reaction.

2. *Regurgitation Jaundice.* Reflux of bilirubin from canaliculi into blood because of obstruction to outflow of bile or necrosis of liver cells (disruption of continuity of canaliculi). Positive direct van den Bergh reaction. (a) necrosis of liver cells and (b) obstruction of bile ducts.

In retention jaundice the bilirubin is retained in the blood because of the inability of some of the polygonal cells to

excrete the pigment brought to them for clearance. These cells may be anatomically intact but functionally incapable and as a result some of the bilirubin is left in the blood. This type includes the hemolytic, the mild hepatocellular, the non-obstructive and the dynamic type of medical cases of other classifications. In hemolytic disorders the rate of bilirubinglobin production is greatly increased and notwithstanding the enormous reserve capacity of the polygonal cells to filter the pigment brought to them, some pigment is left in the blood because these cells cannot cope with the tremendous quantity of bilirubin produced in these conditions. Here we are dealing with the combination of factors, namely, (1) overproduction of bilirubin and (2) impaired cell function. In hemolytic anemia the diminished functional capacity is due to anoxemia and the toxic effects of excessive red cell destruction. In congestive heart failure the polygonal cells go through a process of anoxemia due to blood stagnation in the lung. This stagnation is followed by destruction of large amounts of erythrocytes with formation of excessive quantities of bilirubin and thus burden the already diminished ability of the anoxic polygonal cells. This condition is more pronounced in pulmonary infarction. In this type the bile ducts are patent and the liver cells show no necrosis.

Regurgitation jaundice is brought about by (1) severe hepatocellular damage and (2) obstruction at some point in the biliary system. If the liver cells are badly damaged by disease such as, yellow fever, malaria or infectious hepatitis, regurgitation jaundice will result because there will be a reflux or whole bile from the bile canaliculi into the bloodstream. In these conditions some liver cells become necrotic and the adjacent bile canaliculi become involved and break down. As a result bile salts as well as bilirubin pass back into the bloodstream. It has been conjectured that these bile salts are the cause of the itching so annoying in obstructive jaundice but absent in hemolytic or retention jaundice. The obstruction can be at some point in the biliary system as far down as the ampulla of Vater. The obstruction will lead to an increase in back pressure which will eventually cause diffusion of direct-reacting bilirubin from the bile canaliculi into the lymph spaces and into the blood capillaries.

Rich's Classification of Jaundice, Laboratory Findings

1. Retention jaundice:
   (1) Indirect van den Bergh
   (2) Stool-urobilinogen present
   (3) Urine-urobilinogen in increased amounts
2. Regurgitation jaundice:
   (1) Direct van den Bergh
   (2) Stool-urobilinogen diminished or absent
   (3) Urine-urobilinogen diminished; bile present

In Rich's classification the qualitative van den Bergh is not sufficiently accurate to be applied to all types of jaundice. Recent investigation has proven that simultaneously there may be two forms of bilirubin in the blood. Therefore, since the qualitative test does not help to differentiate between hepatocellular jaundice and that due to obstruction, we need a different approach.

DIAGNOSIS

As a rule the diagnosis in the average case of jaundice is not difficult. Statistics show that about 65 per cent of icterus cases fall into the surgical jaundice group. Some surveys show that 25 per cent are due to cholelithiasis and associated conditions, 10 per cent are due to benign stricture of the common duct and about 30 per cent are due to carcinoma of the head of the pancreas. Some of the pitfalls in the diagnosis arise mainly because at times the causative factors overlap each other and, of course, produce overlapping phenomena. In a patient with jaundice the presence of bile and urobilinogen in the urine has been considered a sign of liver damage, viz., some form of hepatitis or cirrhosis (medical jaundice). On the other hand, acholic

stools denote the presence of some mechanical interference somewhere along the biliary tree obstructing the flow of bile from the liver to the duodenum, e.g., the obstruction can be caused by a calculus or calculi in the gallbladder pressing on the common duct, by a calculus in the common duct, by a stricture of the common duct, by malignancy with or around the bile ducts or by malignancy at the head of the pancreas. It may also be caused by impacted stone in the ampulla of Vater. Most of the cases with acholic stools are caused by extrahepatic bile duct obstruction; this type is termed surgical jaundice.

Hemolytic Jaundice. This seldom presents a difficult problem. As a rule these patients are chronically ill with very mild jaundice. The familial history, repeated painless attacks of jaundice, the presence of anemia, splenomegaly (often the first sign of the disease), the urobilinogen content of the urine and icterus index below 60, normal stools, reticulocytosis (the reticulocytes may reach from 15 to 30 per cent) and the indirect van den Bergh reaction will establish the diagnosis. The real problem is to distinguish hepatocellular from the common forms of obstructive jaundice, especially when the clinical picture is that of obstruction. In incomplete obstruction, either due to a stone or stricture of the common duct, bile and urobilinogen may be found in the urine and the case may simulate a primary hepatitis. A careful history and a diligent physical examination will help to determine the type. In cases of prolonged obstruction of the extrahepatic bile ducts a secondary hepatitis may follow causing impairment of liver function. In making the diagnosis in obscure cases of jaundice both clinicians and surgeons seek to correlate their physical findings with laboratory data. There is no doubt that many laboratory procedures are of diagnostic and prognostic value; and because the liver is the intermediary organ, many tests have been devised to ascertain the true state of the liver.

Hepatic Function. Many difficulties are encountered in the determination of the functional efficiency of the liver with laboratory procedure. Certain functions of the liver may be disturbed more than others. Liver activity is intimately associated with other organs and in the study of these functions it is considerably difficult to point out with precision the particular liver factor involved. Moreover, the liver possesses enormous functional reserve and remarkable regenerative powers so that in certain conditions it is possible that the organ may be the seat of extensive chronic disease and yet carry on its functions in an apparently normal manner. Experiments have demonstrated that when one entire lobe was resected, the liver grew in time almost to its original size. The growth seems to take place by cell proliferation and cell hypertrophy. It is amazing how in this new growth the liver architecture is reproduced and normal liver functions established. The functional activity may be impaired even in the absence of demonstrable morphologic changes. Keeping these facts in mind the results obtained by the tests on liver function will be of great clinical significance. Attempts to interpret functional findings in terms of disease diagnosis or the determination of hepatic parenchymal changes may lead to serious error.

There is no liver function test or group of tests that completely delineates the function of the liver. These tests have been grouped under the title Liver Function Tests: (1) metabolism of bilirubin and its products, (2) ability of liver to excrete dyes, (3) liver activity in carbohydrate metabolism, (4) liver activity in protein metabolism, (5) liver activity in lipoid metabolism, (6) detoxifying function of the liver and (7) liver activity in water metabolism.

Pigment Metabolism and Its Products. Normally, the serum bilirubin concentration in adults is 0.1 to 0.5 per 100 cc., being below 0.5 mg. in about 75 per cent of the cases. It increases with excessive blood

destruction. A physiologic hyperbilirubinemia is present during the first several days of life reaching the maximum intensity at about the fourth day and falls during the following week. This is due to the polycythemia which is followed by a high rate of blood destruction associated with some degree of inadequacy of hepatic cell function in removing bilirubin from the bloodstream. In my opinion it should be emphasized that the determination of the serum bilirubin concentration (quantitative van den Bergh) is the only positive means of detecting conditions of latent jaundice and gives a clearer idea of the severity of and variations in hyperbilirubinemia than does the examination of the urine or feces or the study of skin pigmentation.

Icterus Index. This is useful clinically because of its simplicity and of the intensity of the yellow color of the serum which is usually dependent upon the bilirubin concentration. In the presence of carotenemia, atabrine and other vegetable pigments the icteric index is increased and does not reflect the bilirubin content of the serum. The icterus index in jaundice cannot be used as a measure to determine the amount of bilirubin in the blood. The estimation of the serum bilirubin concentration can better be determined by the quantitative van den Bergh. For such a procedure the Malloy and Evelyn test can be used or the Thannhouser and Anderson method. The reagent gives a specific color reaction in the presence of bilirubin and it is an accurate guide in determining whether the bilirubin wave is increasing or diminishing. The qualitative van den Bergh will help to distinguish hemolytic jaundice from the obstructive type or that due to hepatocellular degeneration but does not help to differentiate the last two types. It is clear how in obstruction a direct-reacting bilirubin reaction can be obtained but it is not so clear how in severe hepatocellular disease the same reaction is observed unless we can visualize that the liver cells lining the bile canaliculi are destroyed or that the bile canaliculi are obstructed by inflammatory exudate and concomitant edema with possible bile thrombi acting as a plug so that direct-reacting bilirubin is thrown back into the circulation.

Urobilinogen Significance. The variations in the amount of urobilinogen in the hepatic and biliary tract disease are determined by (1) the degree of impairment of bilirubin excreted by the hepatic cells, (2) the presence and degree of obstruction to the flow of bile and (3) the presence and severity of an associated hemolytic process. Absence of urobilinogen in the urine in patients with jaundice denotes complete obstruction of the common duct. The determination of urobilinogen may be of great value in distinguishing jaundice due to calculus in the common duct and jaundice due to a neoplasm of the ducts, duodenum or head of the pancreas. In common duct obstruction due to a stone the obstruction is seldom complete whereas that due to a neoplasm usually becomes permanently complete. Watson observed that absence of urobilinogen in the urine was a constant finding in obstruction due to neoplasm. He also observed that urobilinogen in the feces was within normal range in obstruction due to a calculus (10 to 250 mg. daily) whereas it was very low or absent in those with malignant obstruction. He further states that urobilinogen is oxidized to urobilin and considers it of hepatic origin but stercobilin is of intestinal origin. The quantitative estimation of urobilinogen in the feces is seldom employed but may be of great value in certain conditions of hepatic or biliary tract disease. The quantity of urobilinogen in the feces depends on the amount of bilirubin entering the intestines. The morning urine may contain relatively large quantities of urobilinogen. The rate of elimination varies from hour to hour and day to day. Estimation should be made with a twenty-four-hour specimen and should be repeated for five consecutive days. The normal range for urinary uro-

bilinogen is from 0 to 3.5 mg. a day; the fecal is from 40 to 280 mg. per day.

Plasma Protein Metabolism. The liver plays an important role in the synthesis of serum albumin; hence in liver damage, particularly chronic cirrhosis, the formation of albumin is diminished and the ratio may reverse itself. The total normal serum protein concentration is 6 to 8 Gm. per 100 cc. of which 3.6 to 5.6 Gm. is represented by the albumin and 1.3 to 3.2 Gm. by the globulins. In obstructive jaundice the serum protein is usually not altered unless the condition is of extremely long duration. In chronic liver disease the serum protein ratio is considerably altered. The decrease in serum albumin in hepatic disease has been attributed by some chiefly to coexisting malnutrition and by others chiefly to interference with regeneration of serum albumin resulting from impaired liver function. Fibrinogen is formed in the liver. In the presence of severe liver damage the fibrinogen contents of the blood plasma may fall to extremely low levels. In early hepatic disease the fibrinogen plasma determination is of little value but low levels are usually indicative of extensive liver damage.

Takata-Ara. A positive Takata-Ara test reaction usually indicates a reversed albumin-globulin ratio. It may also mean a diminished production of the albumin and an increase in the globulin fraction. The test is not specific for hepatic insufficiency. However, when evidence of chronic hepatic disease is present such as in chronic cirrhosis, a positive reaction is confirmatory.

Vitamin K is a fat soluble substance required for the formation of prothrombin which is an essential factor in the mechanism of coagulation of blood. So far as is known the chief function of vitamin K lies in its utilization by the liver for the formation of plasma thrombin. In man a substance possessing vitamin K activity is formed by the putrefactive bacteria in the intestines. Deficiency of this substance manifests itself by showing a low plasma prothrombin level. Bile acids appear to act as carrying agents for the passage of vitamin K across the intestinal wall. Absorption from the intestines is impaired in the absence of bile (bile acids) in the intestines such as is observed in obstructive jaundice or in external bile fistula. The liver is the chief site for the formation of plasma thrombin. It follows then that a normal functioning liver is essential for the proper utilization of vitamin K in this process. In uncomplicated cases of obstructive jaundice administration of vitamin K will be followed by an elevation of plasma prothrombin whereas in hepatocellular damage it will not be followed by the same response. For this reason vitamin K can be used as a test for liver function. Decrease in prothrombin is evidenced by the prolongation of clotting time (prothrombin). It has been observed that bleeding occurs in patients with obstructive jaundice or bile fistula when the plasma prothrombin concentration falls below 30 to 40 per cent of normal.

Prothrombin Clotting Time. This should be estimated before and after administration of vitamin K. Delay in the prothrombin clotting time demands delay in surgical procedures and indicates the urgent need of vitamin K. Failure to obtain reduction of the prothrombin clotting time with adequate administration of vitamin K usually indicates severe hepatic disease even if the jaundice is primarily of obstructive origin.

The *cephalin-cholesterol flocculation* test (Hanger) and the thymol turbidity tests (Maclagan) due to their sensitivity in detecting the presence of liver disease are receiving considerable attention. Both these tests are dependent on a qualitative change in the serum gamma globulins. These tests are simple and can be used as an office procedure. They can be used to differentiate hepatocellular jaundice from obstructive jaundice. In obstructive jaundice both tests remain negative whereas in hepatocellular disease both tests are positive. These liver tests may reveal persistence of the liver disturbance long after the bile pigment has disappeared from the blood and

urine. Positive reactions may occur in obstructive jaundice when the disease is complicated by cholangitis or carcinomotosis.

The *bromsulfalein test* determines the excretory function of the liver. It has proved to be the most satisfactory test because it is less toxic and less irritating than most of the other dyes. It leaves the bloodstream within a few hours after it has been injected. A dose of 5 mg. per Kg. of body weight given intravenously is preferable and a blood specimen is taken forty-five minutes after the dye is given. Any dye remaining after the forty-five minutes indicates liver damage. Abnormal retention of the dye has been attributed to impaired Kupffer cells function, to dysfunction of the reticulo-endothelial system or both. This test is very valuable to determine hepatocellular damage. The degree of retention will roughly indicate the extent of hepatic functional impairment. It gives no information as to hepatic function in cases of obstructive jaundice. The majority of observers agree that in portal cirrhosis, particularly, dye retention may occur in the absence of hyperbilirubinemia. Abnormal retention of bromsulfalein in the blood occurs almost invariably in acute hepatic disease. This is true of all varieties of hepatitis and acute and subacute hepatic necrosis due to any cause. Some observers believe, therefore, that this test is of value in the early detection of hepatocellular damage in patients receiving hepatotoxic agents for therapeutic purposes such as arsphenamine and carbon tetrachloride. This test is of great clinical value in cases of hepatic dysfunction in which hyperbilirubinemia is absent such as portal cirrhosis, cholecystitis cholelithiasis, toxemia of pregnancy, chronic hepatitis, etc. This will prove the biphasic liver cell activity. The liver may be able to excrete bilirubin, a normal excretory product, but may fail to eliminate bromsulfalein, a foreign substance.

Carbohydrate Metabolism. The galactose tolerance test is of value only in the early stages of liver damage. It can be used to differentiate jaundice due to hepatocellular disease such as in infectious hepatitis and that due to obstructive jaundice. The test is normal in obstructive jaundice whereas it is positive in hepatocellular disease. The excretion of 3 Gm. of galactose in five hours is considered abnormal.

Lipoid Metabolism. Cholesterol and cholesterol ester fraction will give considerable information in separating obstructive from hepatocellular jaundice. It has been observed by many investigators that an elevation occurs in obstructive jaundice but not in parenchymatous disease of the liver. It must be remembered that hypercholesterolemia is common in pregnancy, arteriosclerosis, hypothyroidism and in the nephrotic syndrome.

The cholesterol ester is usually lower in acute degeneration of the liver; and when this phenomenon is observed, it reflects the severity of the damage. In patients with common duct obstruction it should be regarded as of a serious prognostic significance.

Alkaline Phosphatase Determination. Phosphatase activity at present is not considered a good factor in differential diagnosis. Some reports show that in obstructive jaundice serum phosphatase activity and serum bilirubin concentration increase proportionately until the limit of phosphatase activity is reached, 40 to 60 (Bodansky) units, whereas in hepatocellular jaundice the serum phosphatase rarely rises above 12 units (Bodansky) notwithstanding a progressive increase in serum bilirubin. This observation is not shared by other observers.

The *hippuric acid test* shows the detoxifying power of the liver and in the presence of renal insufficiency the reliability of this test may be altered. It has not been accepted as one of great importance to measure hepatic function.

Liver biopsy has some advantages but it is slightly dangerous. Duodenal drainage can be used to determine whether any bilirubin passes into the duodenum.

Infectious Hepatitis and Homologous Serum Hepatitis. Infectious hepatitis is now widespread throughout the world. It has now become endemic in our civilian population and should not be confused with other conditions. This condition has been given many names such as catarrhal jaundice, epidemic infectious jaundice and infective jaundice. Most current views tend to regard catarrhal jaundice as a sporadic form of infectious hepatitis. The etiology is probably a filterable virus traveling up the duodenum and along the biliary ducts into the liver. It should not be confused with Weil's disease. The latter has a different epidemiology, runs a more severe course and is caused by the Leptospira hemmorrhagica. The virus of catarrhal jaundice is not visible with the electron microscope. It passes through the ordinary filters and has not been transmitted to the ordinary laboratory animals. The virus withstands freezing, thawing and heating up to 56°C. for sixty minutes. The manner in which the disease is transmitted is not definitely known. Investigation has proved that contagion does not take place through the respiratory tract. The intestinal tract seems to be the most likely portal inasmuch as fecal extract have transmitted the disease. Contaminated water, milk and uncooked food are believed to be the most frequent means of infection. The virus can be inactivated in drinking water which has been filtered and strongly chlorinated. The liver shows three distinct pathologic features, namely, parenchymal damage, reticuloendothelial involvement producing portal obstruction and periportal inflammation which may produce both parenchymal and obstructive types of jaundice. There is a pre-icteric stage which may last several days or even longer. The prodromal symptoms may simulate an upper respiratory infection or a gastrointestinal upset. The disease may usher in with fever, chills, malaise, headache, anorexia, fatigue, upper abdominal discomfort and digestive disturbance. Abdominal pain, when present, is usually in the right upper quadrant and may radiate to the shoulder or to the back simulating a gallstone colic. It has been estimated that 28 to 80 per cent of the patients fail to develop jaundice. These patients most likely are not diagnosed. When jaundice appears, it progresses rapidly and reaches its peak in a few days, sometimes a week or two, and then slowly subsides. During the icteric phase the liver becomes enlarged and tender. Sometimes the spleen becomes palpable. During the icteric stage the fever has a tendency to be lower. A common symptom during this stage is epigastric fullness simulating a surgical abdomen. The urine is darkly colored and the stools are clay colored for a time. The last stage is the phase of convalescing. A small percentage of patients die and will present the picture of acute yellow atrophy of the liver. The laboratory findings are those of hepatocellular jaundice which have been previously described. In view of the evidence pointing to gastrointestinal portal of entry the prophylaxis would be to ensure clean water, food and good sanitation. The blood of these patients should not be used for transfusion for several years after the last episode. Convalescing patients should not handle food intended for others.

Homologous serum jaundice has the same pathology and clinical picture as infectious hepatitis but there are some fundamental differences between the two diseases. In hemalogous serum jaundice the causative agent may be found in human serum. It may follow the injection of blood or its products as in transfusion. Cases have been reported after inoculation with yellow fever vaccine which contained human serum. The incubation period is much longer than infectious hepatitis ranging from several weeks to six months. The mortality is greater than infectious hepatitis. The sedimentation rate is not increased in the early stage of acute infectious hepatitis, probably because the bile salts have an inhibitory action. After a few weeks of the disease the sedimentation rate rises from 25 to 50 mm. and remains

elevated during the early period of convalescence, falling to normal levels late in the period of recovery. This sedimentation rate test is simple and is more sensitive than the cephalin flocculation test in determining complete recovery from infectious hepatitis.

SUMMARY

Thus the subject of jaundice has been briefly reviewed by outlining the pathogenesis, the various classifications and by enumerating the most important liver function tests. In obscure cases of jaundice a definite diagnosis cannot be made on the basis of one test alone. The method of study of my patients includes a careful history, a diligent physical examination and an examination of blood, urine and feces: blood, complete blood count and hemoglobin, icterus index, van den Bergh (qualitative and quantitative), total proteins, albumin-globulin ratio, prothrombin time, cholesterol and cholesterol esters, cephalin flocculation and thymol turbidity tests; urine, for urobilinogen and bile; feces, for urobilinogen and bile.

Recent studies by electrophoretic methods have demonstrated an increase in the gamma globulin of the serum in patients with hepatic disease. Electrophoretic methods surpass all others in sensitivity and accuracy but this test required too much time and the cost of the apparatus makes it so that its use is restricted to medical centers and research institutes.

Briefly, the surgical indications are: (1) obstruction either due to a stone or to some extrahepatic mechanical interference to the natural flow of bile, (2) complete acholia, (3) development of jaundice after cholecystectomy and (4) biliary fistula.

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INJURIES LIMITING THE MOBILITY OF THE THUMB*

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IT has often been said that the thumb is the most valuable single component of the human hand. Its peculiar virtues are largely due to its mobility and to its function of opposition to the fingers. The hand is essentially a prehensile and manipulative organ with especially acute stereognostic sense. When the mobility and opposition of the thumb are lost, the grasping and manipulative functions of the hand are immediately reduced in direct proportion to the degree of limitation of motion of the thumb. It is estimated that as much as 40 per cent of the function of the hand is lost when the thumb is missing.[1] In the treatment of injuries of the thumb it must be clearly understood what constitutes normal and useful function. In the neutral position the thumb lies at the side of the hand with its nail at a right angle to the plane of the palm. Flexion of its phalanges cannot be accomplished to the same degree as flexion of the fingers chiefly because of the absence of a third segment. In full extension the thumb lies dorsal to the plane of the hand and usually hyperextension of the proximal and distal joints is readily accomplished. Adduction is carried out by the transverse and oblique adductors which constitute the main bulk of the tissue between the first two metacarpals thus squeezing the thumb against the side of the hand and scraping it across the palm. The adductors also aid in efficient pinching by helping to stabilize the thumb's metacarpal. The most useful function of the thumb is that of opposition in which the digit is brought around in front of the fingers chiefly by the opponens pollicis so that its nail lies parallel to the plane of the palm. This action involves all of the joints and includes many motions from that of rotation of the greater multangular on the navicular to slight flexion of the distal interphalangeal joint. In full opposition with the widest abduction there is a 10 cm. gap between the tip of the thumb and the heads of the finger metacarpals. By a combination of opposition and flexion it is possible to use the thumb and any of the fingers as an effective pincers and the strength of the hand's grasp is largely dependent on the stability of the opposing thumb.

It is apparent that the mobility of the thumb depends on three factors: (1) the integrity and liberty of action of its musculotendinous apparatus, (2) the proper alignment of its bones and the mobility of its joints from the carpus distally and (3) the redundancy and elasticity of the skin and subcutaneous tissue of the thumb's web space.

If any of these requisites is compromised, the function of the thumb and, therefore, of the hand will be reduced in concomitant degree.

Trauma to the web space, the metacarpal and the thenar eminence are common in military injuries and by no means rare in civilian ones. The adequate treatment of the resultant disability offers no particular difficulties if the aforementioned anatomic facts and the general principles of plastic surgery are borne in mind.[2–9]

When the patient presents himself for treatment immediately after injury to the thumb or its contiguous structures, proper cleansing and débridement, the anatomic suture of tissues and immediate closure of

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the skin defect, by flap or free graft if necessary, will do much to lessen the magnitude of subsequent reconstructive procedures. Weckesser's recently reported case[10] is an excellent example of how immediate aggressive and purposeful treatment can shorten the time and degree of disability in such instances.

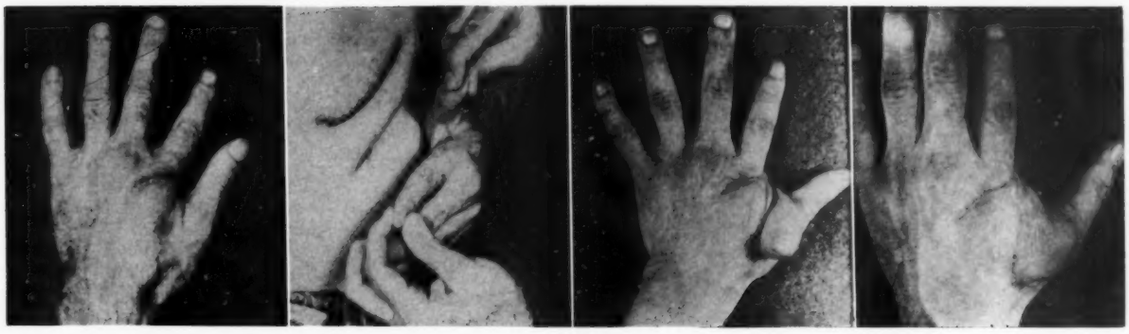
When the patient is not seen until some time has elapsed after injury, treatment will depend on accurate appraisal of the type and extent of the damage. The amount of skin loss must be estimated. The degree of destruction of the thenar muscles must be ascertained. The bones and their articulations must be carefully studied by means of x-ray. Associated injury to nerves, chiefly the volar digital nerves of the thumb and index finger, the motor thenar branch of the median and the deep motor branch of the ulnar, are to be looked for. The adherence of flexor and extensor tendons in the scar should not be overlooked and the possibility of repairing those tendons by direct suture or graft must be borne in mind.

After accurate appraisal of the extent of the damage has been made, treatment resolves itself into correcting the anatomic defects and producing a thumb that will function as nearly normally as possible.

The first consideration is usually removal of scar. After severe injury in the region of the thumb it is not uncommon to find that loss of tissue and scarring in the web space has resulted in a contraction deformity that holds the thumb against the side of the hand or prevents full abduction and opposition. To correct this condition calls for removal of all the scar and coverage with sufficient pedicle skin to allow free excursion. It is important to realize that when the scarred skin is removed, abduction may still be limited by deeper cicatrix; this is sometimes due to direct trauma to the structures but frequently is found to be caused by fibrosis and contracture of the thumb adductors. It may also be a result of aseptic necrosis following occlusion of the first dorsal metacarpal and arteria princeps pollicis branches of the radial artery. In any case if these muscles are destroyed, the resultant cicatrix must also be excised, after which the thumb will usually become freely mobile. Such loss of scarred, functionless muscles causes no serious disability. When the pedicle skin is applied, it should be generous in amount and accompanied by enough subcutaneous tissue to fill out the web space and if necessary provide a bed for the future transplantation of tendons and nerves. Much of the benefit of the operation will be lost if the pedicle skin is applied in such a way that the suture lines lie at right angles to the flexion creases or form a circular scar at the base of a digit. In the former instance subsequent contraction of the scar will limit motion and in the latter a circular scar will tend to constrict the base of the digit so that its venous and lymphatic drainage is obstructed. The abdomen is generally the most suitable donor site for pedicle skin; although in special instances when not much skin is needed, the inner aspect of the opposite upper arm is quite satisfactory.

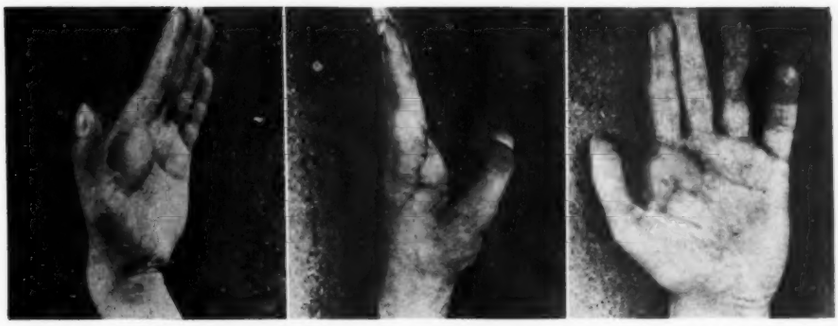
After skin cover has been obtained, further work can be performed. If the thenar muscles have been destroyed, satisfactory opposition of the thumb can be produced by the tendon and pulley operation described by Bunnell[2] in which one of the flexor muscles of the forearm is passed around a pulley and then attached to the dorso-ulnar aspect of the proximal phalanx of the thumb so that it pulls in the direction of the pisiform bone.

Following severe injury it is not uncommon to find that the function of the thumb is compromised by deformity of the metacarpal or lack of mobility of one of its joints, usually the metacarpomultangular. If these conditions exist, reconstruction must include alignment of the thumb in opposition by angular or rotary osteotomy and bone graft when indicated. If destruction of a joint has occurred, arthrodesis is



1A 1B 1C 1D

FIG. 1A to D. Case I.



2A 2B 2C

FIG. 2A to C. Case II.

3A 3B

3C 3D 3E

FIG. 3A to E. Case III.

4A 4B 4C 4D 4E 4F

FIG. 4A to F. Case IV.

usually necessary as a stable, painless post for opposition is of greater value than a mobile one which is painful or unstable.

Not infrequently tendons are divided or are adherent in the scar and volar digital nerves are severed or partially destroyed. A detailed description of the correction of these injuries is not applicable here. Any such repair that is necessary can be done in combination with one of the other procedures after satisfactory skin cover has been obtained.

If there is any general rule applicable to the repair of the disability under discussion, it is first to remove all of the scar and provide adequate skin cover and to correct whatever other deformities that may be present. In illustration of the principles described herein certain cases are presented which demonstrate the problems commonly encountered.

CASE REPORTS

CASE I. E. C., two years following a small caliber gunshot wound of the web space of the thumb, had considerable limitation of abduction and opposition. (Fig. 1A and B.) Figures 1A and B illustrate the widest abduction of which the patient was capable. In order to correct his deformity it was necessary to excise the scar of the web space together with the fibrotic adductor muscles; the resultant defect was covered with a generous amount of pedicle skin. (Fig. 1C.) A satisfactory final result was obtained after rearrangement of the pedicle skin. (Fig. 1D.)

5A 5B 5C 5D 5E

FIG. 5A to E. Case V.

CASE II. H. H. in another hospital had had a traumatic defect of the web space repaired by the application of pedicle skin. (Fig. 2A.) The result was not entirely satisfactory because of redundancy of the transplanted skin and because the suture lines crossed the normal flexion creases at right angles thus limiting full motion of the thumb and index finger. Removal of excess fat from beneath the pedicle and rearrangement of the scars with due consideration of the flexion creases produced both cosmetic and functional improvement. (Fig. 2B and C.)

CASE III. Explosion of a dynamite detonator cap in the patient's (W. M.) hand resulted in a deformity due to destruction of the thenar eminence, adherence of the flexor pollicis longus and brevis tendons in the palm and division of the median nerve in the palm. The thumb was fixed in the position shown by dense scar. (Fig. 3A.) The first stage in reconstruction is shown in Figure 3B after excision of all the scar, median neurorrhapy and application of tubed pedicle skin. The irregularity of the suture lines to avoid crossing flexion creases at right angles should be noticed. The final result was obtained by tenolysis of the flexors of the thumb. (Fig. 3C, D and E.) The opposition demonstrated is a trick movement produced by flexion in the presence of partial fixation of the metacarpal as the opponens pollicis was destroyed along with the rest of the thenar eminence. Sensation of the thumb was satisfactorily restored.

CASE IV. J. G., ten months after having received a shell fragment wound at the base of his thumb, presented the disability shown in Figure 4A and B due to destruction of the thumb metacarpal and division of the extensor tendons. The application of pedicle skin is shown in Figure 4C after excision of all scar. In Figure 4D, E and F is shown the result obtained after prolonging the metacarpal and fixing it in useful position by iliac bone graft and by threading an extensor tendon graft through the pedicle fat.

CASE V. C. W. sustained loss of the entire index ray and fracture of the thumb's metacarpal when he was struck by a shell fragment. After healing had occurred, his thumb was immobile in a non-functioning position. (Fig. 5A and B.) Following excision of the scar and application of pedicle skin mobility was gained; by osteotomy of the metacarpal the thumb was swung around in front of the hand. (Fig. 5C.) In Figure 5D and E the gain in opposition and abduction is shown after completion of the procedure.

SUMMARY

The causes of disability following injury in the region of the thenar eminence and the web space of the thumb are enumerated. The anatomic and physiologic principles underlying treatment of the disabilities are discussed. A rational plan for the reconstruction of hands disabled in this way is proposed. Illustrative cases are reported to demonstrate the more important factors involved in the care of such injuries.

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According to Murray M. Braaf, migraine is frequently caused by slipping of the upper cervical intervertebral discs subsequent to trauma to head or neck or both. He believes radiculitis (neuritis) of the upper two cervical nerves eventually results and causes the periodic, characteristic migraine attacks, and he has obtained successful results by head traction manipulation and therapy with Vitamin B_1. This is indeed an interesting observation but the real value of this procedure cannot be determined until a few more years have passed and this therapy has been carefully practiced on many hundreds of patients who have been carefully followed-up for at least a few years. (*Richard A. Leonardo, M.D.*)

OPERATIVE TREATMENT OF SUPPURATIVE LESIONS OF THE BONY PELVIS

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THE postoperative outcome in a series of forty-three patients with pyogenic lesions of the bony pelvis will be reviewed on the basis of pathologic anatomy, duration of the disease and operative methods in order to formulate a surgical policy in regard to these infections.

TABLE 1
OUTCOME RELATED TO PATHOLOGIC ANATOMY

		No. of Cases	Healed	Drained	Died
Localized lesions	Sacroiliac				
	Osteomyelitis	10	9	0	1
	Arthritis	4	4	0	0
	Ischium	2	0	1	1
	Pubis	2	2	0	0
	Ilium	1	1	0	0
	Sacrum	1	0	1	0
	Coccyx	1	1	0	0
	Total	21	17	2	2
	Per cent	..	80.9	9.5	9.5
Combined lesions	Hemipelvic	4	1	1	2
	Ischium and hip	5	4	1	0
	Ilium and hip	3	2	0	1
	Trisacral	3	1	0	2
	Ilium, bilateral	2	2	0	0
	Ischiopubic	2	2	0	0
	Pubis and hip	1	0	0	1
	Ilium bilateral and hip	1	1	0	0
	Ischium, hip and opposite ilium	1	1	0	0
	Total	22	14	2	6
	Per cent	..	63.6	9.09	27.2

Outcome Related to Pathologic Anatomy (*Table* 1). The infection began in the sacroiliac region in fifteen cases, ilium in ten, ischium in eight, pubis in five, sacrolumbar in three and sacrum and coccyx in one case, respectively. About one-half involved more than one bone. The most extensive combined lesions were named trisacral and hemipelvic. Four of these manifested amyloidosis; two recovered. Trisacral foci involved the sacrolumbar spine and both sacroiliac joints. The postmortem diagnosis in two such cases was subacute osteomyelitis of the lumbosacral spine and innominate bones, chronic infectious arthritis of the sacroiliac joints, thrombosis of the right common iliac and left iliac veins and multiple decubitus ulcers. A white male aged fifteen recovered. He was operated upon one year after onset during an intercurrent amyloidosis. Hemipelvic infections involved one ilium and at least two other homolateral bones. The urinary bladder was perforated by sequestrums of iliac origin in two such cases and

1A

1B

FIG. 1. Retrograde tracking from ischial focus (post mortem) in female aged sixty three years, six years after onset and thirty-one days after resection. A, (*A*) head of femur dislocated manually; (*B*) acetabulum; pus burrowed anteriorly at (*C*) over Poupart's ligament (*D*). B, retroperitoneally to diaphragm; (*X-X*) strip of gauze through purulent track over Poupart's ligament.

in one from a pubic focus. A female aged nineteen finally recovered after nine years of an illness whose severe complications epitomized the worst features of pelvic osteomyelitis.

The most devastating and common complication of all pelvic infections was purulent tracking. This was especially notable in hemipelvic and trisacral lesions. From these necrotic bony septa, which almost literally divided the patient in two, pus tracked both upward (paradoxical) and downward (gravitational). The extent and bizarre character of these aggressive abscesses were seldom appreciated clinically. (Fig. 1.)

The double developmental origin of the sacroiliac joint influences the pathogenesis and pathology of infections in this region. Although the sacroiliac joint develops as do other arthrodial joints, cavitation begins later and progresses more slowly. Brooke (1924) found that the articular cartilages increased progressively from birth from 1.4 sq. cm. to 17.5 sq. cm., all areas being slightly less in females. Therefore, infections here occur usually in the older age groups. Shunke (1938) showed that the thickness of the articular cartilage of the ilium was about one-third that of the sacral articular cartilage. He also found small perforations which permitted marrow and blood vessels to come into contact with these cartilages. The joint is thus vulnerable to invasion from a juxta-articular osteomyelitis, especially the ilium. The converse is not true due to a tendency for primary infections of the joint to perforate the joint capsule early, especially anteriorly. The gravity of sacroiliac osteomyelitis was directly proportional to the depth of sacral involvement and its threat to the contents of the sacral canal and not to the secondary infection of the joint.

A division of this series into pre-and postpuberty groups upheld, on the whole, Goullioud's concept of the pathogenesis of this disease. (Fig. 2.) There were fifteen cases up to thirteen years inclusive. The localizations of these infections were four infracotyloid, three supracotyloid, three ischiopubic, two anterosuperior ilium, one coccyx, one primary sacroiliac joint infection and one body of the pubis. Paracotyloid lesions invariably affected the hip joint early. Foci farther away did not affect it until much later in the disease. There

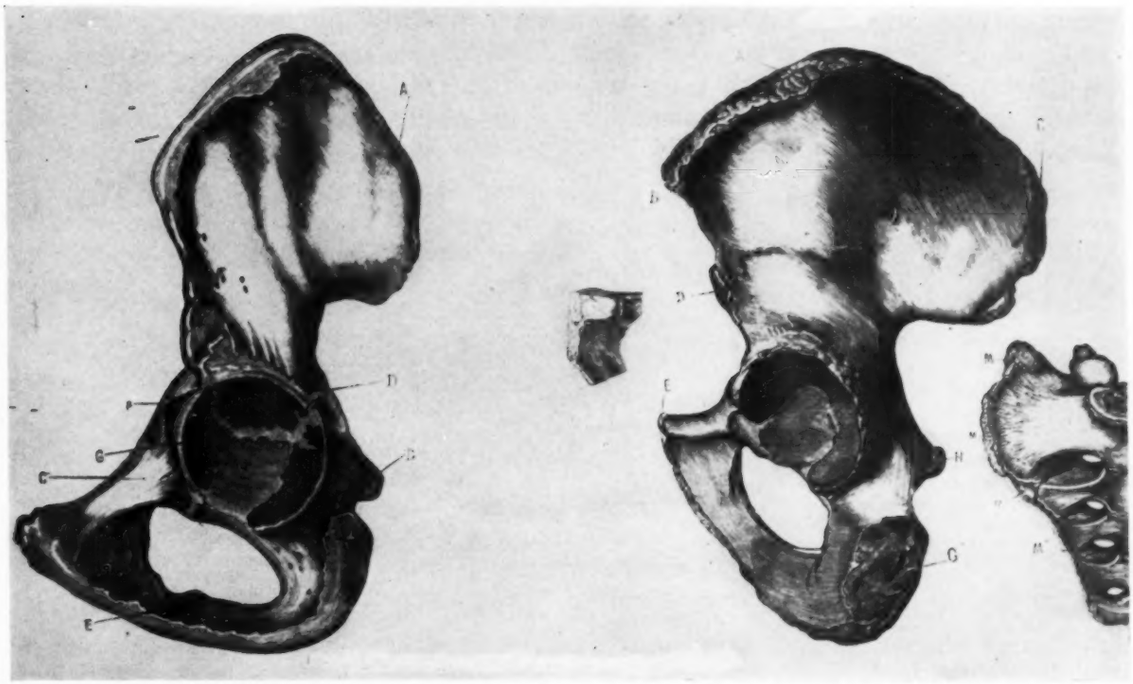

FIG. 2. From Paul Goullioud, Lyons, France, 1883. Left to right: child of twelve years, adult thirty-three years and sacrum of the same individual. Goullioud divided osteomyelitic infections of the pelvic girdle proper into two groups corresponding to its two main developmental periods. The first extended from infancy to puberty when the three bones composing the acetabulum fuse ("primitive acetabular coxalgia"); the second, from puberty to the appearance and fusion of the secondary marginal ("crown") epiphyses at about twenty-five years.

were nineteen patients between the ages of thirteen and twenty-five years with lesions as follows, namely, eight sacroiliac osteomyelitis, three sacroiliac joint infection, three trisacral, three body of ischium, one horizontal ramus of pubis and one wing of the ilium.

Outcome Related to Interval Between Onset and Operation (*Table* II). There were fifteen patients admitted to the hospital in the acute stages; six in the first week and three in the second, third and fourth weeks, respectively. Only two patients were operated upon on their respective days of admission. Both were in their third weeks and showed obvious extraskeletal abscesses. They were prepared for surgery in a matter of hours and did well afterward. Five acute patients were operated upon in the second week, four in the third and one in the fourth week. The remaining five cases were carried over into the subacute stages. The failure to heal occurred in a patient with an ischial focus in whom a resection was done in the third week. The fatality occurred after secondary revision of a pubic focus and resection of a femoral head in the ninth week.

Thirteen patients were operated upon in the subacute stages; three in the fifth week, two in the sixth week and four in the seventh and ninth weeks, respectively. The only failure was a sacral lesion. There were in addition five sacroiliac lesions, three ischial, three iliac and an ischiopubic focus. One patient with iliac focus required eight secondary operations but remained well for six years after the last one. Six of this group required secondary operations.

Nine patients were operated upon in the early chronic (A) stages. Five of these required secondary operations. There were six sacroiliac lesions and one iliac, ischial and pubic focus, respectively. The fatality occurred four months after a total resection of the sacroiliac joint in an adult male.

The operative results in the late chronic stages were disasterous. Deaths occurred

twelve, fifteen, seventeen, thirty, thirty-two days and five months after operations, respectively. There were four iliac, two ischial and five sacroiliac lesions in this group.

three months. Furthermore, four of the five acute lesions healed after simple drainage of the extraskeletal abscesses alone. (Fig. 4.) However, in one of these the abscess was apparently delayed until the

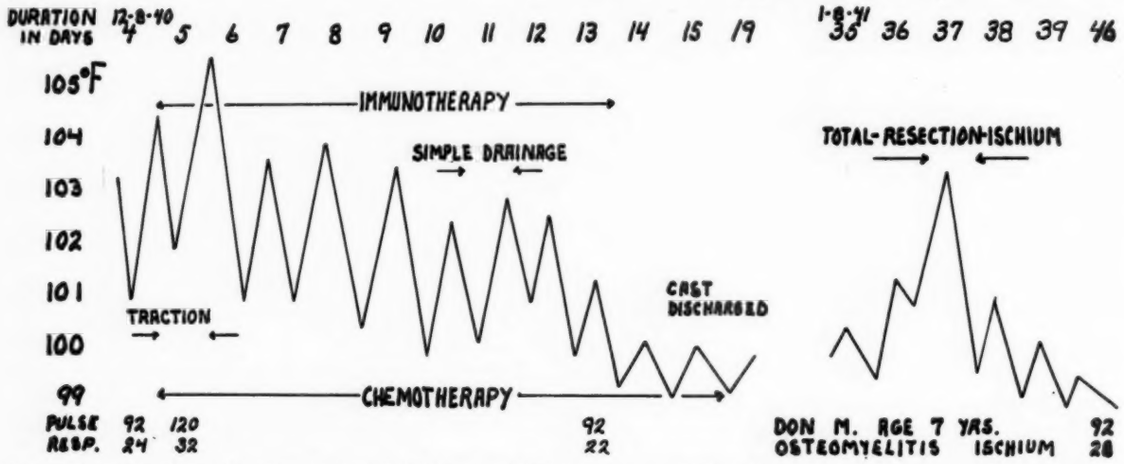

FIG. 3. Graphic chart showing clinical life history of ischial osteomyelitis in boy aged seven years admitted on the fourth day of illness. The febrile reaction was curtailed by sulfonamides, staphylococcus antitoxin and a well timed incision and drainage on the eleventh day; subsequent resection done on the thirty-seventh day.

Ten patients also got chemo- and antibiotic therapy. Five were in the acute stages. Two of the latter were given staphylococcus antitoxin* in addition to

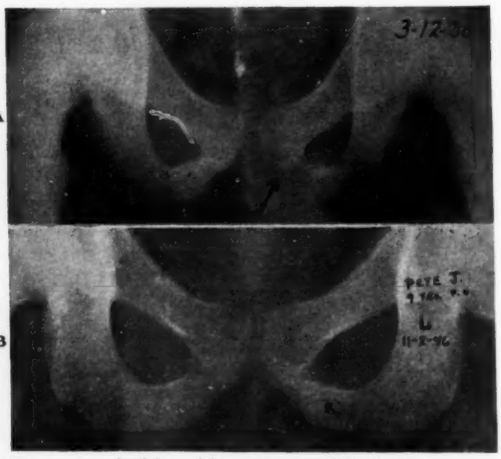

FIG. 4. A, ischiopubic osteomyelitis in boy aged thirteen years, five days after onset; sulfonamides plus incision and drainage on the ninth day. B, same patient almost nine years later.

chemotherapy. These two seemed greatly benefited. The sulfonamides curtailed the initial period of febrile reaction. (Fig. 3.) Prior to their use this fever lasted for about

* Supplied by Lederle Laboratories.

second month by the sulfonamides which had been given in the first week. In other words, the initial improvement in this case

TABLE II
OUTCOME RELATED TO INTERVAL BETWEEN ONSET AND OPERATION

Stage of Disease*	Lesion	No. of Cases	Healed	Drained	Died
Acute	Isolated	6	6	0	0
	Combined	4	2	1	1
	Total	10	8	1	1
	Per cent	..	80 0	10.0	10.0
Subacute	Isolated	6	5	1	0
	Combined	7	7	0	0
	Total	13	12	1	0
	Per cent	..	92.3	7.6	0.0
Early chronic (A)	Isolated	7	6	0	1
	Combined	2	2	0	0
	Total	9	8	0	1
	Per cent	..	88.88	0.0	11.11
Late chronic (B)	Isolated	4	2	1	1
	Combined	7	1	1	5
	Total	11	3	2	6
	Per cent	..	27.27	18.18	54.54

* According to illness at operation cases were classified as acute, in the first month; subacute, between two to three months; early chronic (A), between four to twelve months and late chronic (B) thereafter.

may be considered to have been a spurious one. Hip-joint involvement and subsequent ankylosis occurred in the three paracoty-

loid foci in this group. The fifth patient had to have a secondary ischial resection. (Fig. 3.) Five patients were given sulfonamides and penicillin in the subacute and early chronic stages; three of these healed.

The best operative results were obtained in the subacute and early chronic (A) stages when some degree of balance had apparently been struck between the patients and their infections; in other words, when a relative immunity had been established. It goes almost without saying that our observance of Orr's principle of postoperative rest helped to preserve this favorable situation. The same conditions prevailed well into the early chronic (A) stages, then gradually tapered off and were finally exhausted in the later chronic stages (B). The latter patients reacted allergically during flares and recrudescences to ill advised operations. The same thing happened in the acute stages in varying degrees and probably for the same reasons.

Crossen's studies (1936), the advent of chemo- and later antibiotic agents refined the operative indications in acute hematogenous osteomyelitis in general. Now the pendulum has swung toward the extremes of conservatism in this regard. In our acute pelvic cases operation was gradually withheld until an extraskeletal abscess could be demonstrated by diagnostic puncture and aspiration. It has been supposed that intramedullary pus perforated the thin cortical bones of the pelvis early. This was seldom the case before the second week of the disease except in rare instances in which the infection began in the cortex itself or even subperiosteally. More rapidly developing abscesses are usually para-osseous in origin. The slow evolution of abscesses originating in the bony pelvis due in part to their depth and inaccessibility makes operation inaccurate and impractical in the early days of the disease.

Outcome Related to Operative Methods (*Table* III). Twenty-three patients were operated upon in Iowa City, seventeen in St. Joseph and three in the naval service. All but two of the latter infections were hematogenous in origin. One sacral and one ischial infection resulted from gunshot in combat. The ages ranged from three to sixty-three years and averaged fifteen years. The majority were in the second decade. There were twenty-three females and twenty males. One female died as against seven among males. Half of the deaths occurred between forty-one and sixty-three years. Two deaths were operative. Upward of 150 operations had been done after admission to the hospital. Only eight patients had an incisional drainage prior to that. Fourteen cases (35 per cent) were associated with infectious foci elsewhere in the body. Twelve of these were osseous foci and two were solitary metastases to soft tissues. Three of the pelvic foci operated were secondarily metastatic. Therefore, nine or 22.5 per cent of this entire series metastasized to other bones of which three were single and six were multiple.

TABLE III
OUTCOME RELATED TO OPERATIVE PRINCIPLES

Operations		No. of Cases	Healed	Drained	Died
Primary	Secondary				
Conservative	None	5	3	0	2
	Per cent	..	60.0	0.0	40.0
Conservative	Conservative	2	2	0	0
	Per cent	..	100.0	0.0	0.0
Conservative	Radical	9	7	0	2
	Per cent	..	77.77	0.0	22.22
	Total	16	12	0	4
	Per cent	..	75.0	0.0	25.0
Radical	None	17	12	2	3
	Per cent	..	70.5	11.7	17.6
Radical	Conservative	4	4	0	0
	Per cent	..	100.0	0.0	0.0
Radical	Radical	6	3	2	1
	Per cent	..	50.0	33.3	16.6
	Total	27	19	4	4
	Per cent	..	70.3	14.8	14.8

* The conservative method employed incisional evacuation and drainage of an extraskeletal abscess. The radical method implies, in addition to this, some type of direct attack upon the bony lesion. The primary conservative operation was tentative; the radical was definitive.

A primary conservative operation was done in five acute cases. This sufficed to heal the respective lesions in two instances (ischiopubic). Three cases required further radical operative interference; these healed.

Of four acute patients treated with primary radical operations two healed and two were still draining after further radical attacks. The subacute lesions healed either from a primary radical operation or from a primary conservative and secondary radical approach. The early chronic lesions came out best from primary radical operations. The late chronic stages did poorly regardless of what kind of primary operations were done.

Among sixteen patients who were subjected to primary conservative operations eleven required further operations. The results in this group were twelve (75.0 per cent) healed and four (25.0 per cent) deaths. Of twenty-seven patients subjected to primary radical operations ten required secondary operations. The results in this group were nineteen (70.3 per cent) healed, four (14.8 per cent) not healed and four (14.8 per cent) deaths. The results from

TABLE IV

OUTCOME RELATED TO OPERATIVE TECHNICS

A. POSTERIOR LESIONS:	Primary Operation	Secondary Operation	No. of Cases	Healed	Drained	Died
Sacroiliac Osteomyelitis	Conservative	Partial resection	1	1	0	0
	Conservative	Total resection	2	1	0	1
	Partial resection	None	1	1	0	0
	Total resection	None	1	1	0	0
	Total resection	Revisions	2	2	0	0
	Smith-Petersen	Conservative	1	1	0	0
	Smith-Petersen	Partial resection	1	1	0	0
	Smith-Petersen	None	1	1	0	0
Sacroiliac Arthritis	Conservative	Conservative	1	1	0	0
	Conservative	Partial resection	1	1	0	0
	Curettement	None	1	1	0	0
	Smith-Petersen	None	1	1	0	0
Trisacral	Conservative	Partial resection (one sacroiliac)	2	1	0	1
	Partial resection (sacroiliac bilateral)	None	1	0	0	1
Sacrum	Curettement	None	1	0	1	0
Coccyx	Coccygectomy	None	1	1	0	0

B. ANTEROLATERAL LESIONS:	Primary Operation	Secondary Operation	No. of Cases	Healed	Drained	Died
Ilium	Total resection	Revisions	1	1	0	0
	Partial resection	None	2	1	0	1
	Trepanation	Conservative	2	2	0	0
	Conservative	None	3	1	0	2
	Partial resection	Conservative	1	0	1	0
	Conservative	Partial resection	2	2	0	0
Ischium	Total resection	None	5	3	1	1
	Total resection	Revision	1	0	1	0
	Saucerization	None	1	1	0	0
	Conservative	Total resection	1	1	0	0
Pubis	Conservative	None	2	2	0	0
	Conservative	Conservative	1	1	0	0
	Curettement	None	1	1	0	0
	Sequestrectomy	Revision and excision femoral head	1	0	0	1

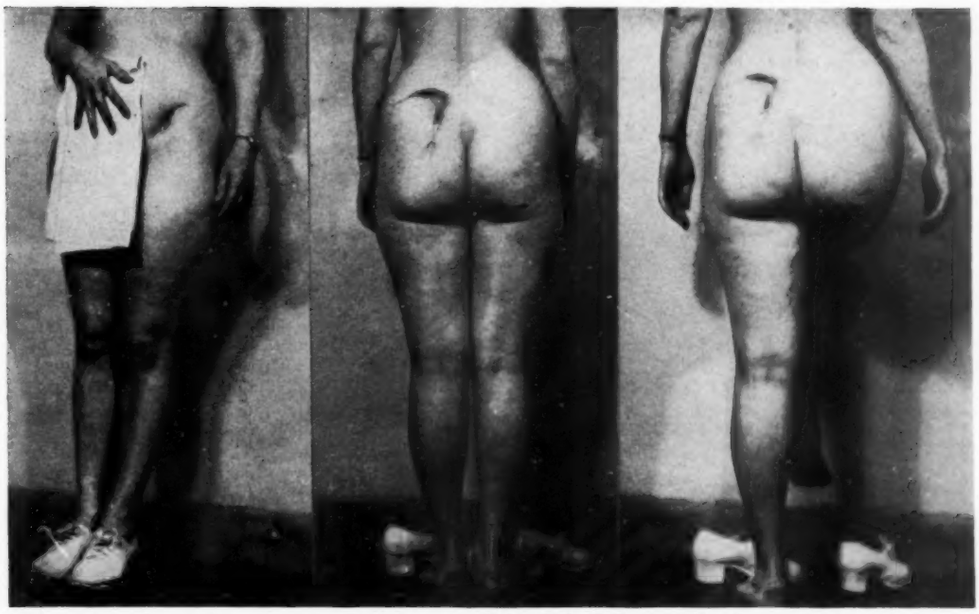

FIG. 5. Female aged twenty-nine had osteomyelitis of the left sacroiliac bones eight years previously. Primary anterior drainage done in the fourth week of illness; total resection in the seventh week; metastasized to the left upper tibia five years later.

multiple operations in general were sixteen (76.19 per cent) healed, two (9.52 per cent) failures to heal and three (14.28 per cent) deaths. The outcome from primary operations alone were fifteen (68.18 per cent) healed, two (9.09 per cent) failures and five (22.72 per cent) deaths.

Operative Technics (*Table* IV). Among the operative technics used resective methods are to be remarked. Pelvic lesions lend themselves to eradicative attempts. This is not an argument for indiscriminate mutilation. On the contrary, subperiosteal resection should be reserved for the residual irreversible disease process (infectious necrosis). The amount of bone to be removed either piecemeal or *en masse* has due regard for future biomechanical demands. The rules of safety to be rigidly observed include the following, namely, extensile approach (Orr and Henry), scrupulous attention to hemostasis, avoidance of injury to important vessels and nerves by remaining in the subperiosteal planes and utilization of Orr's principle of adequate postoperative rest. The postoperative pitfalls are extension of the disease process, blockage of drainage and tracking, hemorrhage, breakdown of the wound margins, perforation of pelvic viscera and persistent sinus formation.

For infections of the sacroiliac bones and joints the Bardenheuer-Picque method was done thirteen times upon twelve patients (one bilaterally). There were eight males and four females. One operation was done in the acute stage, three in the subacute (Fig. 5), two in the early chronic and six in the late chronic stages. Four were done in the second decade, five in the third, one in the fourth and two in the fifth decades. The postoperative follow-up was from eight months to ten years and averaged about five years. The outcome in general was nine (75 per cent) healed and three (25 per cent) deaths. Exclusive of three trisacral lesions so treated the results were nine (90 per cent) healed and one (10 per cent) death. (Fig. 6.) The removal of more than the allowable 1 inch of sacral bone in one total resection resulted in an incontinence of the bowel and bladder. (Fig. 7.) In another patient the superior gluteal artery was injured but was fortunately clamped; the clamps were released after seventy-two hours without subsequent

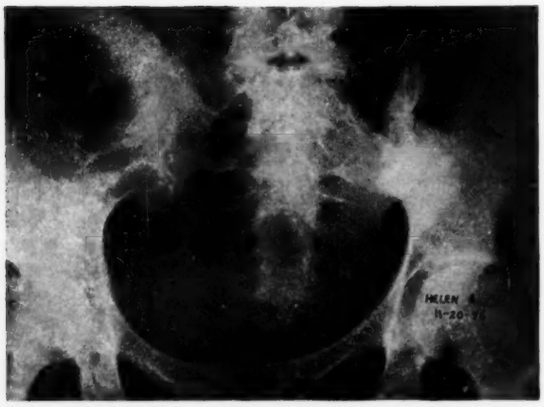

FIG. 6. Female aged twenty-eight had sacroiliac osteomyelitis left eight years previously. Primary drainage anteriorly in the fourth week of illness; partial resection in the sixth week.

FIG. 7. Female aged thirty-one had extensive sacroiliac osteomyelitis nine years previously. Primary total resection in the fourth week of illness; revision of postoperative sinus three months afterward. Overzealous removal of the affected sacral bone resulted in a relative incontinence of the bowel and bladder. (Figure 9 same patient.)

bleeding. Fatal hemorrhages have been reported from that source.

The distinction between primary infection of the sacroiliac joint and sacroiliac osteomyelitis has operative implications. The former can be controlled by simple drainage of the extra-articular abscess. It is to be remembered that a true osteomyelitis seldom, if ever, occurs from a primary infection of the joint. On the other hand, a frank sacroiliac osteomyelitis almost invariably demands more radical operative interference.

Seven ischial resections were done; there were four males and three females. Six resections were done by a posterior approach (J. K.) and one by the combined technics of McWhorter (1929) and Milch (1934). The outcome was four (54.14 per cent) healed, two (28.57 per cent) draining and one (14.28 per cent) death. The follow-up was from four months to fourteen years and averaged over eight years. In three the adjacent segment of the acetabulum was removed in addition to the ischial bone in order to enhance drainage of an already affected hip joint. Two of these were done concurrently with the ischial resection and in one it was performed at a secondary operation. Two of these hip joints came out freely movable. Both of these were done in the subacute stages.

One primary resection was done in the second decade in the acute stage. This patient flared for ten years afterward. Three resections were done in the subacute stages, two in the first and one in the second decades, respectively; these healed. One was done in the early chronic stage in the second decade; he recovered. Two were done in the late chronic stages in the second and sixth decades, respectively. The younger patient failed to heal in the four months he was observed; the other, the oldest patient in the series, died thirty-one days after operation. (Fig. 1.)

Regarding the ilium one total and four partial resections were done in accordance with Badgley's (1934) technic. The total resection was in a twelve year old girl who had an extensive lesion of three years' duration. (Fig. 8.) In the nine years after resection several flares required additional revisions. She remained well for two and a half years after her last operation. Two partial resections were done in the second decades in the acute and subacute stages, respectively; both healed. (Fig. 8.) The partial resection was of little actual help in the lone hemipelvic survivor. The other, a forty-year hemipelvic lesion with a perianal sinus, died from peritonitis after partial resection.

There was concern in the beginning in

8A

8B

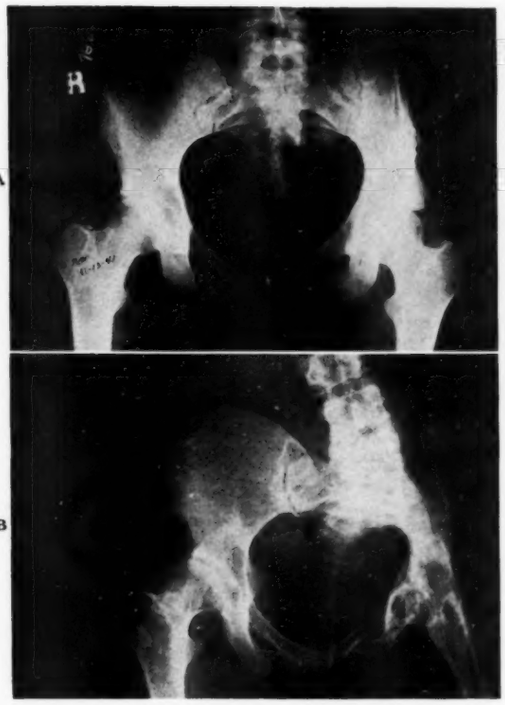

FIG. 8. A, pelvis eight years after partial resection of ilium in ninth week of illness when she was eleven years of age; required several revisions and intervention in addition for metastasis to the opposite ilium. B, eleven years after total resection of the wing of the ilium in a female when twelve years of age in her third year of illness. During nine-year period after operation she required four operative revisions and operations for metastases to femur and opposite iliac wing.

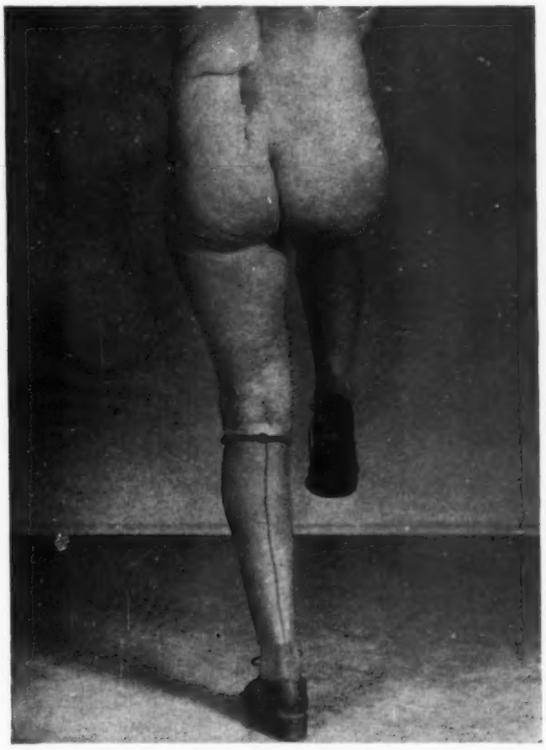

FIG. 9. Same patient as Figure 7; demonstrating stability of the resected side.

regard to dystocia and adverse effects on the gait after resective operations, especially on the sacroiliac bones. Actually the chief locomotor disturbances derived from ankylosis of the hip joint in all cases. The tendency for the remaining portion of the posterior iliac flap to reattach itself to the lumbosacral junction after sacroiliac resections stabilized this region. (Fig. 9.) Several of the patients did limp due to some shortening and complained in later years of recurrent episodes of sciatica and fatigability. Apprehensions regarding dystocia after resective procedures in general were allayed in some degree by the subsequent obstetrical history in six cases. These women were delivered of eleven normal infants at variable intervals after the following operations namely, one ischial resection, two simple drainages for primary sacroiliac joint infection, a curettement in another similar infection and one partial and one total sacroiliac resection, respectively. (Fig. 5.)

COMMENT

The radical operative treatment of pelvic osteomyelitis was urged both by Goullioud (1883) and von Bergmann (1904). Their very zeal failed to convince others. With few exceptions surgeons after them considered these cases as hopeless and did little more than drain obvious extraskeletal abscesses. The plight of these chronic patients stimulated an interest in more adequate surgical treatment some fifteen or twenty years ago in Steindler's Clinic Subsequent experiences with acute and subacute infections, a few of which spontaneously aborted or resolved without suppuration, and the advent of modern adjunctive methods of treatment helped to refine the operative indications. The outcome in general in this series—thirty-one (72.09 per cent) healed, four (9.3 per cent) not healed and eight (18.6 per cent) deaths

FIG. 10. Arrested (non-suppurative) osteomyelitis wing of ilium (proved by biopsy) five months after onset in female aged fourteen.

—is, therefore, the result of a gradually developed surgical policy. These statistical trends are not intended to supercede specific needs based on the merits of any individual case. Exceptions that prove the rule are always to be found. (Fig. 12.) A breakdown of the statistical results emphasizes flexibility rather than a rule of thumb operative attitude in regard to lesions of hematogenous origin. (Table v.)

Such a policy embraces principles of primary and secondary therapeutic control neither one of which is subordinate to the other. These principles embrace the superimposed general and local infections. Primary measures include modern adjunctive medical agents and the initial conservative operation. It is begun in the presence of or a threatening general and/or local infection. A specific diagnosis is not essential at this stage. During the first days of a fulminating infection the patient may die. He is more likely to abort spontaneously under immediate and intensive modern medical treatment. This happened in two recent cases (J. K.) which were not included in this series. Operation is of no help in the first instance and unnecessary in the second. The primary operation is withheld in any case until an extraskeletal abscess can be detected by diagnostic puncture. This procedure is guided by carefully elicited points of surface, rectal or vaginal tenderness. A negative aspiration in the face of subsiding local signs and symptoms indicates a reversible focus, arrestive or non-suppurative evolution of the lesion. (Fig. 10.) A negative aspiration in the face of persistent local signs and symptoms indicates either that the infection is still intra-

TABLE V

CONTROL OF PELVIC PYOGENIC INFECTIONS (ORR METHOD)*

Acute	Subacute	Early Chronic (A)	Late Chronic (B)
Antigenic	Relative Immunity		Allergic
Bony Residue			
Fatal Abortive Arrestive	None Reversible		
Suppurative	Reversible	Irreversible	
Primary Control		Secondary Control	
Adjunctive Treatment			
Primary conservative operation		Secondary radical operation Primary radical operation	Palliative operation

* Epitomizes the primary and secondary control of hematogenous infections of the bony pelvis.

medullary or has simply not been reached by the needle. In regard to para-acetabular foci a positive puncture outside the joint is characteristic but not pathognomonic for para-acetabular osteomyelitis. A positive puncture both from within and without the joint is inconclusive in regard to the primary source of infection. A positive aspiration of the hip joint alone is pathognomonic for primary infection of the joint.

A pitfall to be avoided either from the onset of extraskeletal suppuration or adjunctive treatment is the favorable general reaction which is sometimes observed. Surgical vigilance must be maintained despite this apparent or real early improvement. This needs emphasis since there is a growing tendency to withhold operative drainage to see what will happen without it, especially in those patients who are being treated with adjunctive medical agents. So long as the extraskeletal abscess

has been demonstrated clinically, the indications for incisional evacuation and drainage are clear-cut and ought to be executed without further delay in order that tracking may be prevented or minimized. This This is the surgeon's gravest responsibility.

The obstacles to the early diagnosis of pelvic osteomyelitis are too well known to be reiterated. From the operative standpoint one will do best by depending upon puncture and aspiration. This gives a reasonably early surgical diagnosis which, if adequately followed up, will do much to avoid the hopelessness of the late chronic (B) stages of the disease. Furthermore, several indirect roentgenographic changes are helpful. In regard to lesions of the pelvic girdle proper these include clouding of the obturator foramen (obturator sign), soft tissue swellings and fascial plane distortions about the hip joint. In regard to posterior lesions primary infection of the sacroiliac joint is almost always manifested by a so-called unhooking at the symphysis pubis. (Fig. 11.) Sacroiliac osteomyelitis is associated, on the other hand, with a contralateral pelvic shift. (Figs. 6 and 7.) The former is due to an abnormal rotary movement in the affected joint and the latter to an exaggerated movement of these bones in the frontal plane.

The final diagnosis must rest upon adequate laboratory investigations. In this series the pyogenic nature of the lesions was established thus in all but one case. A question of concurrent skeletal tuberculosis was raised in two cases because of a single positive guinea pig—among several others which had been negative—in one case and on the finding of a few tubercles in tissue removed at operation in the second. Both lesions involved sacroiliac regions which ended fatally. An exhaustive postmortem study in the first instance failed to reveal any evidence of tuberculosis anywhere in the body. The same opportunity for study was not available in the second case. In the face of such inconclusive microscopic evidence of tuberculosis in this case it was considered to be pyogenic.

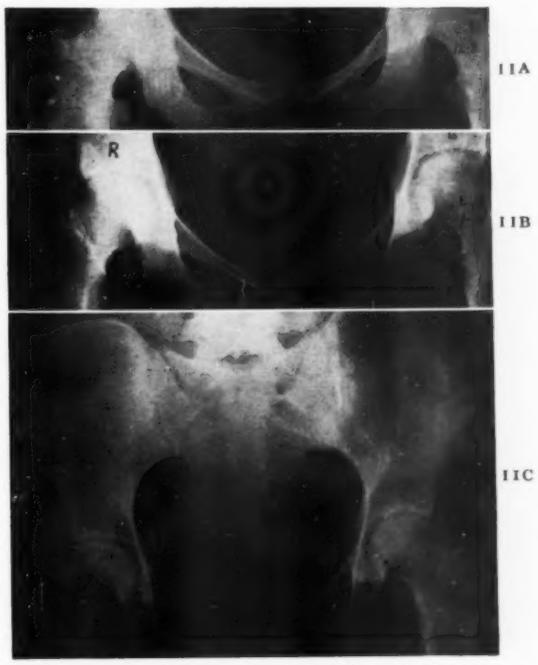

FIG. 11. Evolution of "unhooking" due to primary infection of the sacroiliac joint in female aged twenty-five years. A, twenty-one days after onset; B, forty-nine days after onset; C, thirteen months after onset.

By the same token sterile blood and local cultures by routine methods are inconclusive. Such findings are to be checked to exclude unusual bacterial forms. This is particularly significant in view of the specificity of modern chemo- and antibiotic agents. The growth of mixed bacterial organisms may indicate a secondary invader or faulty laboratory technic. Rarely, mixed bacterial forms may mean the existence of bacterial synergism and symbiosis. This was thought to be the case in one of our earliest patients wherein over a six-year period of observation hemolytic staphylococci and streptococci were consistently recovered from the blood stream and an amazing number of soft tissue and skeletal metastases. These lesions were characterized by intensive destructiveness and almost complete absence of reactive productivity on microscopic examination. This infection burned out only after fifty-five operations had been performed.

The secondary control of the disease deals directly with the residual bony lesion

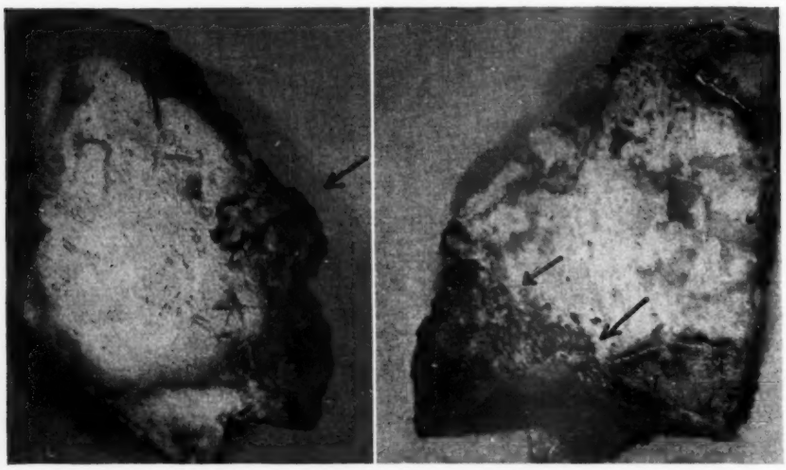

FIG. 12. Surgical specimen, anterior superior quadrant of ilium (female aged nine years), removed in the third week of illness after primary incision and drainage on the fifth day; central avascular area demarcated by zone of hyperemia.

and emphasizes eradicative measures wherever this is feasible. The extent of these operations is governed by the relative or absolute irreversibility of the bony process. This evaluation cannot be made with any degree of certainty in the early and subacute stages. It is further to be remarked that under intensive modern adjunctive treatment that reversibility in degree is to be expected even in bone lesions associated with gross extraskeletal abscess and x-ray changes indicative of bone destruction. Thus the distinction between this form and actual infectious necrosis is often difficult to make in the absence of gross sequestration but may be in some cases. (Fig. 12.) In the early chronic stages, however, the roentgenogram and the clinical picture should decide this issue without question.

In conjunction with these two principles of control Orr's principle of adequate rest is to be instituted early by pelvic sling suspension and traction and furthered by plaster casts after operations of any magnitude.

CONCLUSION

Recent developments along lines of so-called medical treatment in acute hematogenous osteomyelitis is shrinking its clinical life history more and more but not eliminating it entirely in some cases. The basic pathogenetic pattern of the disease in these cases will still probably remain the same. There will remain, therefore, some instances of the disease, especially those less frequent or typical localizations most often unsuspected which will need well planned operations. From a study of the postoperative outcome in this series of forty-three cases, small though it is, a surgical policy emerges which embraces a flexible but interlocking program of control in keeping with modern therapeutic trends. These principles anticipate both the unpredictable early clinical life history of these infections, from the general and local standpoints, and their irreversible manifestations. The principles of primary and secondary control represent successive measures from medical to surgical on the background of Orr's great principles of adequate drainage and rest and continued adjunctive care. As such, neither is subordinate to the other. All three components have been emphasized because undue reliance on either one alone tends to confuse the issue of operative intervention in a disease in which the battle for the patient is being so hard won at last.

GERIATRIC SURGERY*

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EACH decade the medical profession is being called upon to do more emergency and optional surgery on patients of sixty and above. Many of these patients require immediate attention for fractured hips, strangulated hernias, acute appendicitis and many more conditions. This has become such a major problem that there is now a journal devoted solely to the care of the aged. In 1941 there were 13,600,000 people over sixty in the United States or about 10 per cent of the total population at that time. This percentage will gradually increase for a number of years as preventive medicine and modern surgery prevent death in the pre-sixty age group.

It seems to me that we have been overrating the danger of surgery in the group of sixty or above. The yardstick we should use to measure age is not that of years but the physiologic and pathologic condition of the patient's major systems. A man of forty-five in poor physical condition may be a worse risk than a well preserved man of seventy-five. Those patients with definite lesions of the circulatory system, kidneys and liver are, of course, more difficult to handle. However, those who have acute lesions must be treated regardless of the danger. This is especially true of patients with acute appendicitis and strangulated hernia. These may be buffered by the use of saline and glucose, plasma and by the best of them all, whole blood. I am a firm believer in the liberal use of whole blood after my experience in World War II in which we saw apparently hopeless patients respond to whole blood and later permit us to do major surgery with great success.

They should be carefully prepared preoperatively and an estimation of their kidney and heart function made. Those with normal kidney concentration over a period of twenty-four hours, moderately good phenolsulfonphthalein function, few casts, normal blood pressure and pulse rate will stand major surgery well. Those with low protein may be improved by plasma or whole blood. The use of nicotinic acid 50 mg. three times a day and other vitamins is of value. In case of optional surgery the patient should be given all the facts and he should then be allowed to make the decision as to whether he wishes surgery. The decision should not be left to the patient's children if he is rational.

Unfortunately many of these patients are emergency cases and something must be done at once to prevent death. Often in the doubtful cases pain must be relieved because continuous, unrelieved pain causes aged people to deteriorate rapidly.

The general indications for surgery in this group are as follows, namely, relief of pain; relief of life-endangering infections; mobilization of a patient out of bed because the dangers of becoming bedridden with pneumonia or other complications are greater than the operative risk, for example, internal fixation of fracture of neck of femur; excision of malignancy; relief of gangrene in peripheral vascular disease and relief of chronic obstructive diseases such as enlarged prostate, pyloric obstruction, etc.

There are exceptions to these general indications such as when the patient is too ill for any hope of cure or palliation.

Careful use of anesthetic and preanesthetic drugs is of importance. The reflexes of old people are much more easily subdued than in the younger group and decreasing muscle tone makes complete muscle relaxation more easily accomplished. Preanes-

* Read at the Texas Surgical Society, San Antonio, Texas, April 6, 1948.

thetic medication may consist of morphine in smaller doses than for the more youthful and atropine or hyoscine 1/150 gr. or less. The same anesthetic agents used in others may be used in this age group but it must be remembered that these people are tender, that they are easily sedated, easily anesthetized and relaxed, and readily overdosed. Therefore, careful watch must be kept during operation for too much anesthetic. Oxygen should always be available. The useful anesthetic agents are the same as for other age groups.

In abdominal cases, especially strangulated hernia, local anesthetic is used when possible and is supplemented with either gas or pentothal if needed. Many men use local anesthetic in the reduction of fractures of the hip and the internal fixation following. Spinal anesthetic is good in cases of obstruction in which there is no hypertension with high diastolic as the pulse pressure may fall so that it cannot be restored. In cases of doubt as to the proper anesthetic agent the old standby of ether supplemented by gas is always good. A new agent that is especially useful in cases of peripheral disease complicated by gangrene in bad risks is the use of crymotherapy. A tourniquet should be applied at or just above the level of planned amputation and the extremity packed in ice for three to four hours before the operation. The patient usually has no shock and can be returned to a normal diet immediately after operation.

I am presenting a group on unselected patients in which the youngest is sixty and the oldest is 110. This group includes hip fractures, intertrochanteric fractures, strangulated hernias, prostatic hypertrophies, malignancies and various other conditions. The reason for the large number of fractures included is because of the type of patients I see and because some included were those of the late Dr. Charles E. Collins. All types of anesthetics were used although spinal was favored in intracapsular fractures of the femur because of the excellent muscle relaxation. No patients died during operation as most were carefully protected from shock by use of saline, plasma and whole blood. All operations were performed as rapidly as possible.

There are 123 cases to be reported and only major surgical cases and major injuries are included. Included are eighteen intracapsular fractures of the neck of the femur, seventeen intertrochanteric fractures of the femur, twenty-one prostatectomies, three leg amputations for arteriosclerotic gangrene, two carcinomas of the pancreas, four strangulated hernias, twelve fractures of the shaft of the femur and forty-six general surgical conditions such as ruptured appendix, malignancies of the colon, stomach and breast, nephrectomies and gallbladders. Of the aforementioned patients none died during the operation, one died twenty-four hours postoperatively and fourteen died varying from one to six months later. Most of the late deaths were usually due to a cardiac condition present at time of operation or as a result of malignancies that were not removable. The total early and late mortality of this series was 15.4. In Table 1, the type of injury, age and deaths of the patients, are given.

TABLE 1

Injury	No.	Deaths	60 to 70	70 to 80	80 to 90	90 plus
Fracture, neck femur	18	3	4	14	0	0
Fracture, intertrochanteric, femur	17	5	3	4	6	4
Fracture, shaft femur	12	4	5	5	1	1
Prostatectomy, suprapubic	21	2	6	14	1	0
Hernia strangulated	4	1	0	1	3	0
Carcinoma pancreas	2	2	1	1	0	0
Gangrene of leg with amputation	3	1	1	2	0	0
Nephrectomy	2	1	0	1	0	0
General surgery	46	2	24	18	4	0

Following is the type of treatment used in the various groups. All fractures of the neck of the femur were treated by internal fixation using either Austin Moore or Knowles pins. The intertrochanteric frac-

tures with few exceptions were treated by well leg traction, usually by a Roger Anderson apparatus. It was believed that most of these patients were too old to treat by internal fixation such as the Austin Moore blade plate or the Smith-Petersen nail with a flange. Most of the simple fractures of the shaft of the femur were handled by skeletal traction if there was displacement of the bone or by plaster hip spica if no displacement was present. Out of a total of forty-seven patients in the previously mentioned three groups there were twelve deaths. One patient with intertrochanteric fracture was a man of 110 who finally died of the debilities of old age four months after his injury.

The twenty-one prostatectomies were all suprapubic and two-stage operations. Two of the patients died, one thirty six hours after suprapubic cystotomy and the other about two months later, having healed completely after operation, gone home and died of complicating myocarditis.

There were four cases of strangulated hernias all in men over seventy. Three recovered and one died twenty four hours later from a coronary occlusion. All were done under local anesthetic using 1 per cent novocain. Two patients with carcinoma of the pancreas died several months postoperatively. Only palliative surgery was done on these. In the three cases of amputation of the lower extremity above the knee all were done for arteriosclerotic gangrene. All patients rapidly recovered from operation and were discharged. One died two months later from a previously known myocardial condition for which she had been taking digitalis for three to four years. Two nephrectomies were done for septic kidney with stones. Recovery was rapid and satisfactory. One patient died eight months later from coronary occlusion.

Among those classed as general surgery were the following: appendiceal abscesses, carcinoma of the breast, acute appendicitis, acute cholecystitis, empyema of the gallbladder, colonic malignancy, lung abscess with putrid empyema and acute obstruction. Of the forty six patients one died soon after surgery and forty five recovered completely. One woman in this series successfully had three major operations between her seventy-first and seventy-ninth birthdays namely, strangulated femoral hernia, acute appendicitis and acute cholelithiasis.

SUMMARY

These unselected cases of geriatric surgery show that successful work can be done on a surprisingly large number of these patients for a variety of conditions. One hundred twenty-three cases are presented with an immediate and late mortality of 15.4. It is urged that more of these old people be given the benefit of surgery instead of assuming that little can be done for them.

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OSTEO-ARTHRITIS OF THE HIP JOINT WITH SPECIAL REFERENCE TO TREATMENT BY CUP ARTHROPLASTY

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WITH every step the hip joint must carry the entire weight of the body. Any limitation in the range of motion or any irregularity of the joint surfaces which causes pain will result in changes in the normal gait ranging from rather minor to complete disability. The magnitude of the disability from a painful hip or worse from two painful hips cannot be exaggerated. Osteo-arthritis of the hip joint, known also as malum coxae senilis, morbus coxae senilis, hypertrophic arthritis and osteo-arthrosis, is a most disabling manifestation of generalized osteo-arthritis. It is more common in men than in women. Although it is much more common in later life, it occasionally manifests itself in the younger age groups. It is most frequently unilateral but bilateral occurrence is frequent enough to make treatment a real problem.

Etiologic Factors. There is no specific etiologic factor in osteo-arthritis of the hip. Perhaps the most important factor is trauma. At the Mayo Clinic we have seen many patients who had what might be interpreted as true osteo-arthritis of the hip joint which had developed after severe and known trauma such as a dislocation of the hip without fracture or other less severe injuries in early life. (Fig. 1.) These conditions should fall into the group of traumatic arthritis but clinically and pathologically, when fully developed, they cannot be distinguished from true osteo-arthritis. Most likely the often repeated trauma of ordinary life on a weight-bearing joint is sufficient in many individuals to produce osteo-arthritis. (Fig. 2.) Other contributory factors, of course, are any conditions which will alter the mechanics of the hip joint such as congenital deformities or aplasias of the spinal column, pelvis, hips or legs. Also, intercurrent disease or injury to any of these parts may hasten the degenerative process in the hip joint.

There is no doubt that the gradually diminishing blood supply of the hip consequent to age and arteriosclerosis or functional vasoconstriction hastens, perhaps in many cases causes, the degeneration of the articular surfaces.

Osteo-arthritis certainly develops in hips which have previously been damaged by an infectious process such as that associated with rheumatoid arthritis or with any specific infection. Here again the problem is that of both a mechanical and a degenerative process.

Pathologic Features. In brief, the fundamental pathologic process in osteo-arthritis is the degeneration of the mucinous portion of the hyaline cartilage. This is followed by fibrillation of the cartilage, which is characterized by a splitting of the matrix prior to complete degeneration and wearing away, leaving a sclerotic subchondral bone plate beneath which cyst-like cavities may be present. These cysts may form also in the ilium about the acetabulum.

The marginal proliferative bone changes about the acetabulum and head of the femur at the insertion of the periosteum and synovium may be caused by the traumatic hyperemia which occurs in these tissues subsequent to the use of the degenerating joint. Loose flecks or plaques of cartilage and osteocartilaginous loose bodies are not uncommonly found in joints which are undergoing such changes.

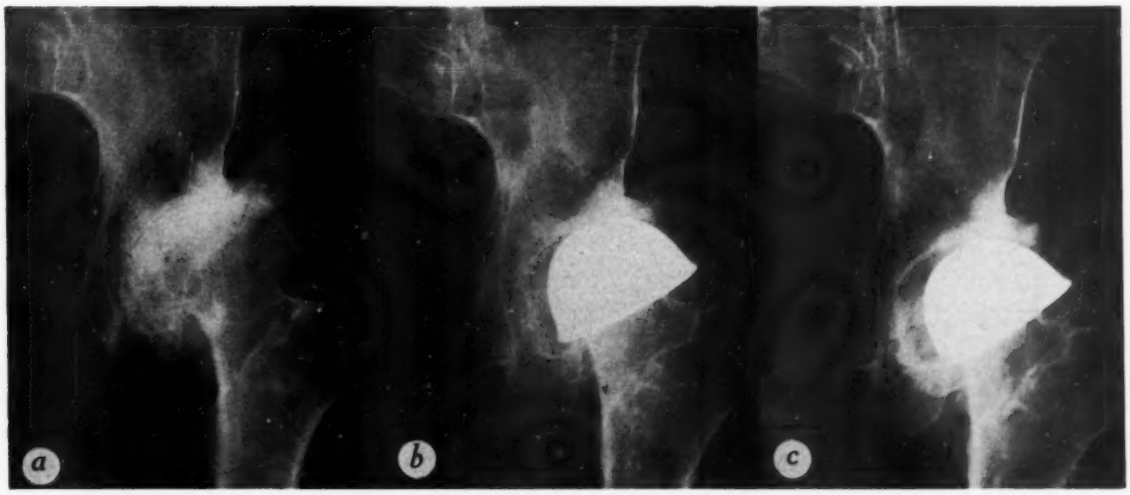

FIG. 1. *a*, Post-traumatic osteo-arthritis of the left hip of forty-two years' duration; *b*, six months after Vitallium cup arthroplasty; *c*, two and a half years after operation. Result at five years after operation was very good.

Roentgenologic Characteristics. Characteristically, there is proliferation of bone with lipping and osteophyte formation. Narrowing of the joint space and marked sclerosis and eburnation of the cortical bone occur. Cyst-like areas of degeneration are present about the articular surfaces. The head of the femur enlarges and becomes flattened on the weight-bearing surface assuming an oval shape. The acetabulum appears large and deep and conforms to the shape of the head of the femur.

Symptoms. It is difficult to state just when the onset of osteo-arthritis in a hip occurs. Many such lesions observed roentgenologically in their inception are asymptomatic but on physical examination one will find some limitation of rotation in the hip. Slowly, progressively and insidiously the process goes on until pain and marked limitation of motion are present. Deformity in the form of adduction and flexion of the hip may take place. Occasionally, trauma appears to be the precipitating factor in the onset of the patient's symptoms.

TREATMENT

Conservative. Conservative treatment of osteo-arthritis of the hip is designed purely to decrease wear and tear on the hip joint and to relieve the pain and muscle spasm. It consists of weight reduction in heavy individuals, avoidance of long hours of standing and walking, and use of a cane or a crutch. Heat, massage and aspirin are about the only agents available for the relief of pain and muscle spasm. Occasionally, changing the relationship of the weight-bearing surfaces of the hip joint by a lift on one heel will help temporarily.

Operative. The most certain way to relieve pain and deformity in a hip affected with osteo-arthritis is by arthrodesis, with the joint fixed in good position. (Fig. 3.) Arthrodesis should be done on a person who subjects his hips to hard use. Several things, however, mitigate against this procedure, namely, patients with a surgically ankylosed hip are somewhat clumsy and some inconveniences attend a stiff hip; in many patients with osteo-arthritis both hips are involved and it is difficult to predict when unilateral disease will become bilateral; a surgically ankylosed hip will not be accepted by some individuals; consequently, various operations have been designed to relieve symptoms and deformity and yet to permit maintenance of motion.

Operations designed to increase the circulation of the head and neck of the femur are the drilling of multiple holes from the trochanteric region of the femur

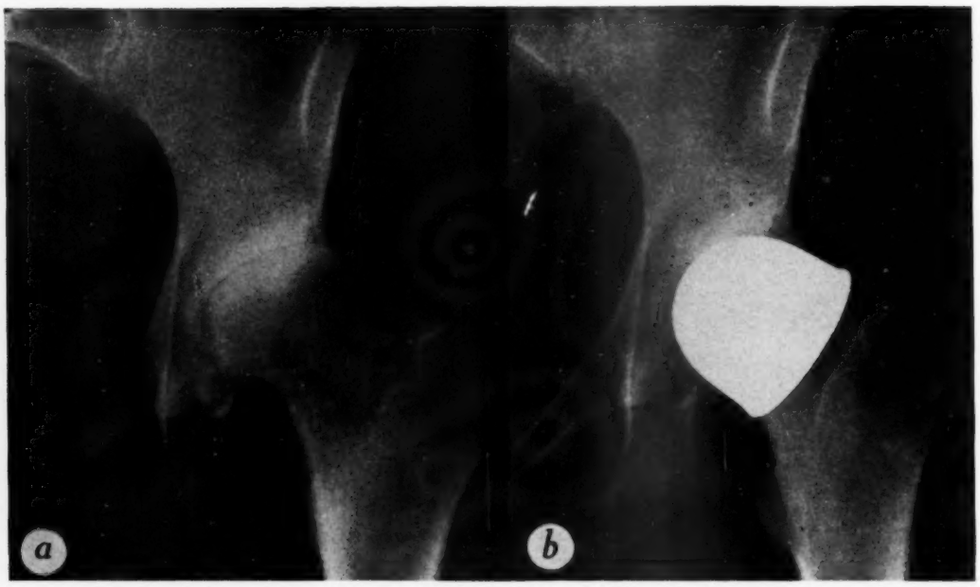

FIG. 2. *a*, Degenerative osteo-arthritis of the left hip joint; *b*, after Vitallium cup arthroplasty. Six months after operation the result was poor but three years and ten months after operation the result was fair.

FIG. 3. *a*, Osteo-arthritis of the right hip before operation; *b*, nine months after arthrodesis there was solid union and good weight-bearing and the hip was without pain.

into the neck and head (Fig. 4) and a guttering operation on the neck of the femur into which a pedicle of muscle is inserted. Temporary and occasionally permanent relief of symptoms is reported but the results have not been very satisfactory.

Partial denervation of the hip joints by sectioning the obturator nerve either by an intrapelvic or an extrapelvic approach has been done for some time and recently has come in for much consideration. On occasion the posterior sensory nerves to the hip joint arising from the sciatic nerve have also been sectioned. The results have not been consistent or predictable in the relatively small series of cases that have been reported. In a few cases at the clinic we have attempted by obturator neurectomy to relieve pain following cup arthroplasty but the results have not been good.

Osteotomy of the upper end of the

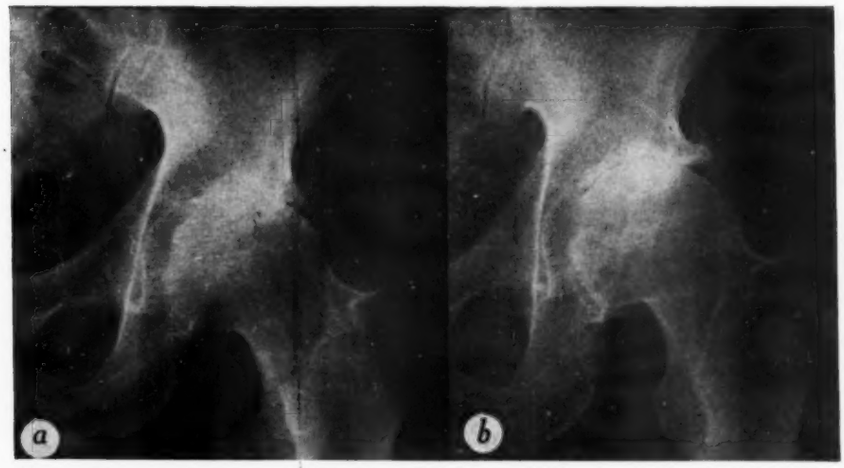

FIG. 4. Traumatic osteo-arthritis of the left hip. *a*, Before operation; *b*, two and a half years after a drilling operation. Some relief was obtained.

FIG. 5. *a*, Preoperative appearance of osteo-arthritis secondary to an old infectious process; *b*, two years after cheilotomy. The result was poor seven years later.

femur to change the relationship of the weight-bearing surfaces of the hip joint has been done and is being done for pain in the hip. While it must be admitted that in some cases the pain is relieved, it is difficult to believe that the relief will be permanent in such a mechanically unsound and incongruous joint.

Cheilotomy and acetabuloplasty have not proved satisfactory in the long run in our hands. (Fig. 5.)

Arthroplasty of the hip joint has been done for years with or without interposing membranes but the results have not been sufficiently encouraging for this procedure to find many advocates until the advent of the Vitallium mold as developed by Smith-Petersen.[1]

PRESENT STUDY

From June 1, 1939, through December 31, 1945, at the Mayo Clinic we did cup arthroplasty ninety-eight times on eighty-eight patients for osteo-arthritis of the hip. Fifty-seven of these patients had unilateral disease and underwent unilateral operation, ten had bilateral disease and underwent bilateral cup arthroplasty and twenty-one had bilateral disease but underwent unilateral operation. (Table 1.)

The ages of the patients ranged from twenty to seventy-three years. There were

fifty-one men and thirty-seven women. (Table II.)

Results. Since it is not fair to group patients who had unilateral disease and unilateral operation with those who had bilateral disease and unilateral or bilateral operation and because the patient must be evaluated as a unit according to his ability to ambulate, the results have been broken down into the three categories given in Table I.

TABLE I
OSTEO-ARTHRITIS OF THE HIP
TYPE OF DISEASE AND OPERATION

	Cases	Per cent
Unilateral disease and unilateral operation	57	65
Bilateral disease and bilateral operation	10	11
Bilateral disease and unilateral operation	21	24
Total	88	100

TABLE II
OSTEO-ARTHRITIS OF THE HIP
AGE AND SEX DISTRIBUTION OF PATIENTS

Age (yr.)	Patients	Per cent
20–29	1	1
30–39	3	3
40–49	17	19
50–59	43	50
60–69	21	24
70 or over	3	3
Total	88	100
Mean age	55 years	
Men	51	58
Women	37	42

The result was considered to be very good when the patient had no pain, could walk up and down stairs, could tie his shoes and could walk without assistance and without a noticeable limp. A good result was considered to have been obtained when the patient had little or no pain, could walk up and down stairs and could walk without assistance or with the assistance of a cane.

A patient was considered to have obtained a fair result when he was satisfied that improvement had been obtained. Pain sometimes persisted but it was less severe than before operation and was bearable. Motion may or may not have been improved. Many patients still used a cane or a crutch. Frequently, deformity and grossly abnormal gaits were improved even though some disability persisted.

A poor result was one in which the condition was not improved by the procedure and the patient was not satisfied. Only a

TABLE III
RESULTS OF UNILATERAL CUP ARTHROPLASTY FOR UNILATERAL OSTEO-ARTHRITIS OF THE HIP ACCORDING TO TYPE OF CUP AND SEX IN FIFTY-SEVEN CASES*

	Patients Traced	Results, Per cent of Traced Patients			
		Very Good	Good	Fair	Poor
Vitallium cup	43	16	54	9	21
Lucite cup	11	..	10	45	45
Men	28	14	40	14	32
Women	26	12	50	19	19
Total	54	13	44	17	26

* Three patients, one man and two women, were not traced.

TABLE IV
RESULTS OF UNILATERAL CUP ARTHROPLASTY FOR BILATERAL OSTEO-ARTHRITIS OF THE HIP ACCORDING TO TYPE OF CUP AND SEX IN TWENTY-ONE CASES*

	Patients Traced	Results, Per cent of Traced Patients			
		Very Good	Good	Fair	Poor
Vitallium cup	14	29	21	21	29
Lucite cup	6	..	..	33	67
Men	15	27	13	27	33
Women	5	..	20	20	60
Total	20	20	15	25	40

* One man was not traced.

few patients thought that they were made worse by the operation.

All patients in this study have been traced and all operations were performed at least one year before the follow-up. An analysis of the results according to sex and type of cup employed is given in Tables III, IV and V. The incidence of very good and good results was greatest in the patients who had unilateral disease, unilateral operation and declined as the extent of the disease and surgical intervention increased. There was apparently little sex preference; if anything, the women did slightly better than the men. This can perhaps be explained by the fact that men demand harder use from their hips than do women.

TABLE V
RESULTS OF BILATERAL CUP ARTHROPLASTY FOR OSTEO-ARTHRITIS OF THE HIP IN TEN CASES*

	Patients Traced	Results, Per cent of Traced Patients			
		Very Good	Good	Fair	Poor
Men	6	17	17	50	16
Women	3	..	67	33	..
Total	9	11	33	45	11

* One woman was not traced.

Lucite cups as visualized in Figures 1 and 2 were not satisfactory. They wore out and fractured. We have long since discontinued use of them although apparently a few of them are still holding up.

In Tables VI and VII the results obtained according to decade of life are presented. Age apparently is no barrier to obtaining a good result if the subject is carefully selected according to physiologic age.

Detailed analysis of these cases revealed that patients should be selected carefully for cup arthroplasty on the basis of physiologic age, temperament and ability to cooperate, reconstructive possibilities as revealed on analysis of roentgenograms, muscle power and occupation.

All patients should be acquainted with the possibilities of failure and success and the alternate operative procedures should be discussed with them. In cases of disease of both hips or in cases in which degeneration of the opposite hip is expected there is no alternative but to obtain one movable hip. Drilling operations, cheilotomy, fascial arthroplasty and others have not stood the test of time. Performance of osteotomy to change the weight-bearing surfaces of an already incongruous and worn-out joint does not seem to be a reasonable procedure. Division of the obturator nerve and of the posterior sensory nerve to the hip joint may help. Such a procedure has not proved of great help in relieving persistent pain

TABLE VI
RESULTS OF UNILATERAL CUP ARTHROPLASTY FOR UNILATERAL OSTEO-ARTHRITIS OF THE HIP ACCORDING TO DECADE OF LIFE IN FIFTY-SEVEN CASES*

Age (yr.)	Patients Traced	Results, Per cent of Traced Patients			
		Very Good	Good	Fair	Poor
20–39	3	33	67	..	..
40–49	12	..	66	17	17
50–59	27	19	30	15	36
60–69	12	8	50	25	17
Total	54	13	44	17	26

* Three patients were not traced.

TABLE VII
RESULTS OF UNILATERAL CUP ARTHROPLASTY FOR BILATERAL OSTEO-ARTHRITIS OF THE HIP ACCORDING TO DECADE OF LIFE IN TWENTY-ONE CASES*

Age (yr.)	Patients Traced	Results, Per cent of Traced Patients			
		Very Good	Good	Fair	Poor
30–49	4	25	25	25	25
50–59	6	17	..	50	33
60–69	7	29	14	14	43
70 or over	3	..	33	..	67
Total	20	20	15	25	40

* One patient was not traced.

following cup arthroplasty; in our hands, however, the number of patients on whom it has been done is not great.

Prostigmine was used after operation in some cases to relieve muscle spasm and pain. The results were not too encouraging although several patients thought it helped considerably. Curare was used in conjunction with physical therapy in a few cases to obtain muscle relaxation, with equivocal results thus far.

Some of the best results were obtained in cases in which the degenerative process or mechanical irregularity of the head of the femur was in the formative stage and the acetabulum was involved only mildly. It is difficult to advise early operation for a patient who has distortion of the hip joint but is not having much pain, although one knows that ultimately the hip will break down. Perhaps in these cases cup arthroplasty should be done before severe secondary osteo-arthritis develops.

Obviously, from the figures presented cup arthroplasty of the hip still leaves something to be desired. However, it is now possible to establish some sort of a trend of results by comparing the results observed in a study undertaken and reported in 1944[2] with results obtained on the same and additional patients reported in this paper. (Table VIII.) With better selection of patients, better operative technic and with time and use of the operated hip there appears to be some reason to believe that our results will improve. The figures reported herein were obtained in spite of the fact that the condition of five patients became worse because of lucite cups, two of which were proved on exploration to be fractured.

The condition of five other patients has improved in the past three years.

TABLE VIII

TREND OF GRADE OF RESULTS IN THE TREATMENT OF OSTEO-ARTHRITIS BY CUP ARTHROPLASTY

Years	Patients Traced	Results, Per cent of Traced Patients			
		Very Good	Good	Fair	Poor
1939–1942*	28	14	30	26	30
1939–1945†	83	14	36	22	28

* Period covered was June 1, 1939, through December 31, 1941.

† Period covered was June 1, 1939, through December 31, 1945.

It is to be remembered that all of these patients demanded some type of radical surgical interference because of pain and disability. A great many of the patients were rehabilitated and were made comfortable by cup arthroplasty. It is believed that this operation has a very definite place in the treatment of osteo-arthritis of the hip joint.

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OBTURATOR NEURECTOMY FOR PAINFUL HIP*

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IN an attempt to relieve the pain associated with various hip conditions, division of the obturator nerve or obturator neurectomy has been performed in twelve cases at The New York Hospital since June, 1947. This paper is a preliminary and brief report concerning the technic and early results. Although articles have appeared on the subject in journals from other countries, a careful search has failed to disclose previous reports in the American literature and it is hoped that this short article will stimulate others to become interested in this simple operative procedure and to help establish whether or not it is of value as an adjunct in the treatment of chronic hip disease.

Obturator neurectomy is an old and familiar procedure for the relief of adductor spasm in spastic paralysis. Selig[1] of Germany in 1914 first described extraperitoneal intrapelvic approach to the obturator nerve and the operation frequently has been referred to as the Selig operation.

Padovani[2] of France described five cases in 1939 in which obturator neurectomy relieved patients suffering from chronic arthritis of the hip joint and recorded one case in which bilateral nerve section was done. The same author reported additional cases in 1942 and 1946.[3,4]

Blixenkrone-Møller[5] in reporting sixteen cases in 1940 in the Scandivanian literature states that the operation is indicated only in cases of true arthritis deformans with adductor contracture. This author describes and extrapelvic approach to the nerve through the pectineus muscle.

Tavernier and Truchet[6,7] of France divide the posterior branch of the obturator nerve and state that the operation is useful in all forms of painful arthritis involving the hip joint. They report 85 per cent good results.

Cottini[8] in the Argentine literature, Mallet–Guy and de Mourgues,[9] and Ricard and Francillon[10] in the French literature also have reported on obturator neurectomy as a treatment for chronic painful arthritis of the hip.

Anatomy. The obturator nerve arises from the anterior divisions of the second, third and fourth lumbar nerves and is a combined nerve with both motor and sensory components. From its origin it pssses through the fibers of the psoas major muscle, descends posterior to the common iliac vessels and courses along the lateral wall of the lesser pelvis to enter the thigh through the anterior part of the obturator foramen. Upon leaving the pelvis the obturator nerve divides into an anterior and a posterior branch. The anterior division, at a point near the obturator foramen, sends a branch to the hip joint as well as branches to the adductor longus, the gracilis and usually to the adductor brevis muscles. The posterior division supplies motor branches to the obturator externus, the adductor magnus and the adductor brevis muscles as well as an articular filament to the knee joint in most cases.

An accessory obturator nerve is reported to be present in 29 per cent of cadavers.[11] This nerve, when present, arises from the anterior divisions of the third and fourth lumbar nerves, descends along the medial border of the psoas major muscle, crosses the superior ramus of the pubis and passes under the pectineus muscle. It sends branches to the hip joint, the pectineus

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muscle and a communicating ramus to the obturator nerve.

There is additional nerve supply to the hip from the sacral plexus, in the form of a twig from the nerve to the quadratus femoris, or from the upper part of the sciatic nerve or from the lower part of the sacral plexus.

Operative Approach. An inguinal extraperitoneal intrapelvic approach has been used in each case in this series. This route was selected in order to assure interruption of the articular rami, which are small and difficult to locate, below the point of division distal to the obturator foramen. The inguinal approach is simple and direct.

A 10 cm. incision is made in the medial one-half of the groin at a point 2 cm. superior and parallel to the inguinal ligament. The aponeurosis of the external oblique muscle is exposed, incised in the direction of its fibers and retracted. The conjoined tendon is reflected upward and, in the male, the cord as well. The transversalis fascia is incised and the peritoneum is retracted superiorly and medially. The obturator nerve is palpated along the lateral wall of the pelvis approximately 3 cm. posterior to the external iliac vessels and is visualized passing through the anterior portion of the obturator foramen beneath the pubic ramus. The nerve is separated easily from the surrounding adipose tissue and stimulation readily identifies it by the contraction of the adductor muscle group. The nerve is grasped, divided and 3 cm. excised as a specimen for the surgical pathologist. After hemostasis is assured, the incision is closed in layers with interrupted silk sutures.

Care must be exercised to avoid injury to the obturator artery which usually arises from the hypogastric artery and courses along the pelvis to pass through the obturator foramen adjacent to and posterior to the nerve. Frequent variations in the origin of the obturator artery necessitate caution. In one case it was found to arise from the inferior epigastric artery, ligation being necessary for adequate exposure. Frequently, particularly in obese individuals, the inferior epigastric vessels require ligation to gain adequate exposure.

General anesthesia was used on all patients except one on whom 1 per cent procaine local anesthesia was used. Two patients received local anesthesia supplemented with sodium pentothal intravenously. There were no complications in the postoperative course of any patient.

TABLE 1
SIGNS AND SYMPTOMS

Painful Motion	12
Limitation of Motion	11
Spasm of Adductor Muscles	11
Limp	7
Significant Atrophy of Thigh Muscles	6
Local Tenderness Over Hip Joint	2
Shortening of Involved Extremity	2
Tenderness of Adductor Muscles	1

Analysis of Cases. Of the twelve patients on whom obturator neurectomy was performed eight were females and four were males. (Table II.) Their ages ranged from twenty-nine to seventy-four years. The chief complaint of each patient was that of a painful hip, the right hip in seven cases and the left hip in five cases. The duration of pain varied from six months to ten years.

Etiology of the hip pain varied. One patient (Case 1) had had a fracture of the femoral neck with fixation by Moore nails six years prior to neurectomy, the nails having been removed five years before. Another patient (Case 2) had scarlet fever with associated suppurative arthritis of the hip treated by incision and drainage twenty years previously. A third patient (Case 4) had had incision and drainage of a suppurative arthritis forty-seven years before the recent admission for an unknown type of arthritis but suggestive of tuberculosis. Two other patients (Cases 5 and 8) had roentgenologic evidences of old Legg-Perthes disease, the latter of the two developing pain during childbirth. Case 11 presented a history and roentgenographic findings compatible with an old slipped femoral epiphysis. The remaining six patients had typical degenerative arthritis

of the hip joint, five of whom showed evidence of degenerative arthritis elsewhere.

The principal physical findings in the group consisted of pain on motion, limitation of motion of the involved hip and spasm of the adductor muscle group. (Table I.)

Laboratory studies other than radiologic were not pertinent. Blood counts, urinalyses, serologies and blood chemistries were within normal limits.

Results. In each case in this series there was significant and prompt relief of hip pain with ten of the twelve patients completely relieved of all hip pain. One patient had occasional pain in the hip and knee on the affected side but was able, however, to discard a brace previously worn for the painful hip. Another patient had pain at the extremes of hip motion upon examination but useful motion of the hip was not painful. Four patients developed subjective

TABLE II

Case No.	New York Hospital No.	Sex and Age	Affected Side	Duration of Pain (Yr.)	Roentgenologic Findings	Result	Length of Follow-up (Mo.)	Comment
1	160358	F 52	R	1	Spur of inferior aspect neck; bilateral osteo-arthritis; retained fragment Moore nail	Good	2	No hip pain; mild low back pain
2	301331	F 29	L	10	Marked hypertrophic arthritis secondary to operative intervention for acute suppurative arthritis	Good	3	No hip pain; mild paraesthesia medial aspect thigh; limp improved
3	306177	M 44	L	8	Degenerative arthritis; soft tissue calcification below joint	Excellent	6	No hip pain; patient felt better than he had in 10 years
4	397967	F 59	L	4	Osteo-arthritis with question of tuberculosis of forty-seven years' duration; osteo-arthritis of lumbar spine	Good	..	No hip pain; gait improved; left sciatica
5	443556	F 44	R	2	Old Legg-Perthes disease, bilateral; worse on right	Good	2	No hip pain; limp much improved; increase in function; patient felt tremendously improved
6	482422	M 68	R	1	Osteo-arthritis of hip and lumbar spine	Fair	3	Occasional hip and knee pain but able to discard brace
7	483703	F 74	R	3	Malum coxa senilis; osteo-arthritis of lumbosacral spine	Fair	6	No hip pain; severe sciatica; slight pain in adductor muscle group
8	484310	F 36	R	8	Degenerative arthritis and probable old Legg-Perthes disease	Excellent	3	No hip pain; full range of motion
9	484397	F 71	L	5	Osteo-arthritis of hip and lumbar spine	Fair	5	Pain at extremes of motion but useful motion is not painful
10	486573	M 67	L	7	Malum coxa senilis	Good	3	No hip pain; paraesthesia medial aspect of thigh
11	487387	M 33	R	5	Old slipped femoral epiphysis with traumatic arthritis	Good	2	No hip pain; slight adductor weakness
12	487976	F 58	R	½	Osteo-arthritis of both hips and lumbosacral spine	Good	3	No hip pain; paraesthesia medial aspect of thigh

abnormal sensation on the medial aspect of the thigh following operation which may have been due to degeneration of the distal segment of the severed nerve or to strain of the adductor magnus by its additional functional load. In no patient was the sensory change more than a minor complaint.

It is important to determine the presence of sciatic pain before operation in order to explain to the patient that such pain will not be improved by the operation. The two patients who developed or became more aware of pain in the distribution of the sciatic nerve on the operated side had extensive osteo-arthritis of the lumbosacral spine.

All patients had improvement in any limp present preoperatively apparently due to the release of pain and spasm following severance of the obturator nerve.

Four patients were aware of postoperative adductor weakness but not sufficiently to limit their activities. Such weakness should not constitute a serious problem because part of the adductor magnus innervation is from the sciatic nerve and the pectineus muscle is innervated partially by the femoral nerve. Hypertrophy of these muscles by increased use should take over the function of the muscles paralyzed by neurectomy.

The final results are summarized in Table II. Classified as excellent are those patients completely relieved of hip pain and without any complaints referable to the extremity. Designated as good are those patients without pain but who had some adductor weakness, subjective abnormal sensation of the thigh or sciatica. The patients called fair are those with marked amelioration of hip pain but without complete relief plus the one patient with severe osteo-arthritis of the lumbar spine associated with sciatica.

COMMENTS

When operative procedures are indicated in the treatment of painful hips after conservative therapy has failed, arthroplasty and fusion are the customary operations with fusion considered to be the better. Both operations are extensive and are not to be taken lightly in elderly patients. Fusion requires prolonged immobilization in plaster and arthroplasty requires special equipment and extensive postoperative physical therapy.

Obturator neurectomy, on the other hand, is a relatively minor operation comparable in procedure to a simple herniorrhaphy, requiring light anesthesia, no special instruments and short hospitalization. If additional operative work is indicated later for the hip disease, the previous neurectomy will not interfere or jeopardize the final result.

The present series is too small and the follow-up too brief to permit any conclusions as to the permanent value of the procedure. It is our opinion that the early results are sufficiently encouraging to cause the procedure to be continued in this institution. The late results, however, are in question inasmuch as the effect of interruption of the sensory innervation to bone and joint structures has been studied in experimental animals by Corbin[12] and Corbin and Hinsey[13] who found that erosion of the articular cartilage of the hip joint and underlying bone sclerosis were produced by section of the fourth lumbar and third sacral dorsal roots and lumbar sympathectomy. However, the majority of the patients requiring obturator neurectomy are in the older age group and consequently are not likely to develop similar changes.

Also, we must know more about the innervation of the hip joint from the sacral plexus. Further investigative work is necessary to determine whether pain deep in the buttock can be eradicated by interruption of the sacral nerve supply to the hip or whether such pain is a true sciatica resulting from the flexion deformity of the hip producing a strain of the lumbosacral joint.

It is our hope that others will be stimulated to try the operation, perform investigative work and help evaluate the place of neurectomy in the treatment of hip pain.

SUMMARY

1. Division of the obturator nerve has been performed on twelve patients with unilateral painful arthritis of the hip.

2. The anatomy and operative approach are described.

3. The findings and results are discussed.

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ACUTE MECHANICAL OBSTRUCTION OF THE SMALL INTESTINE*

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DURING the past forty years the mortality from all types of mechanical obstructions of the small intestine has shown a decline in some clinics from about 60 per cent to less than 10 per cent.[1–5] This improvement in the mortality rate appears to be due primarily to three factors: (1) a better understanding of fluid and electrolyte balance in the dehydrated patient;[6] (2) earlier diagnosis and operative relief of the obstruction[2,4,7] and (3) the development of a satisfactory catheter for intubation and drainage of the small intestine.[8,9,10,11]

This report is based on a review of the records of 177 patients with acute mechanical obstruction of the small intestine, admitted to St. Luke's Hospital over a ten and one-half-year period (January 1939–July 1949). A particular effort has been made to appraise the value of intubation of the small intestine by means of the Miller-Abbott tube or one of its modifications.

ANALYSIS OF CASES

In 157 cases the diagnosis was confirmed by operation or autopsy. In the remaining twenty cases the diagnosis was based on roentgenographic evidence plus the clinical course of the patient. The causes of obstruction were as follows:

Adhesions or adhesive bands	97
External hernia	46
Gallstones	3
Stenosis due to scar tissue	4
Volvulus	3
Internal hernia	2
Meckel's diverticulum	1
Endometriosis	1
Undetermined (probably adhesions)	20

In the group of 177 patients there were twenty-nine deaths, a mortality of 16.3 per cent. Data on the treatment of these patients is shown in Table 1.

Operation without Intubation. There were 131 patients operated upon without the use of small intestinal intubation (in twenty-three intubation was attempted but failed) with twenty deaths, a mortality of 15.2 per cent. Thirty-five of these patients were operated upon within twenty-four hours of the onset of symptoms with one death, a mortality of 2.8 per cent; while in the group of ninety-six patients operated upon more than twenty-four hours after the onset of symptoms there were nineteen deaths, a mortality of 19.7 per cent. The results illustrate the low mortality which may be expected with

TABLE 1
RESULTS OF TREATMENT IN MECHANICAL OBSTRUCTION OF THE SMALL INTESTINE

	No.	Deaths	Mortality (Per cent)
Operation without intubation	131	20	15.2
Under 24 hr	35	1	2.8
Over 24 hr	96	19	19.7
Successful intubation	40	3	7.5
With operation	24	3	12.5
Without operation	16	0	0
Total patients treated	171	23	13.4
No specific treatment	6	6*	100
Total cases (Treated and untreated)	177	29	16.3

* Moribund on admission, 3.
Errors in diagnosis, 3.

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early diagnosis and relief of a mechanical obstruction before distention is pronounced and the patient has become gravely ill.

Small Intestinal Intubation. An attempt to intubate the small intestine by means of the Miller-Abbott or similar tube was made in sixty-three of the 177 patients. The tube passed into the small intestine in forty; in twenty-three it failed to go beyond the stomach. Sixteen patients successfully intubated recovered without surgery and twenty-four required operative relief of the obstruction. There were three deaths, a mortality of 7.5 per cent. This is one-half the mortality rate experienced in the group of patients treated without intubation of the small intestine.

One of the three deaths in this group occurred in a patient on whom operation was delayed one week because of improvement after intubation. There was, however, a gangrenous segment of ileum and death by peritonitis followed resection. The unsuccessful outcome in the other two cases could not be contributed to delay incident to the use of the Miller-Abbott tube.

This series, although not large, confirms the reports of others[3,5,10,12] that successful small intestinal intubation has great value as an adjunct to the surgical treatment of mechanical obstructions of the small bowel although its use is not without risks.

It was our experience that the tube could be passed into the small bowel with little difficulty if the obstruction was of short duration and peristalsis active, while in the acutely ill patient with marked distention attempts to pass the tube were often unsuccessful. In eight cases persistent unsuccessful attempts to pass the intestinal tube delayed operation and appeared to be a real factor in the fatal outcome.

No Specific Treatment. There were six patients not treated by operation or intubation. Three were moribund on admission and three died because of errors in diagnosis which led to inadequate treatment.

Deaths. It was at times difficult to determine the exact cause of death. Those patients not dying because of peritonitis or other obvious reason have been classified as dying from shock. The causes of death were as follows: shock fourteen; peritonitis nine; aspiration of vomitus two; pneumonia two and heart failure one.

An analysis of the records of the fourteen patients listed as dying from shock shows that three were moribund on admission and died before any treatment could be started while two died because of failure to make a correct diagnosis. One infant, age two months, failed to tolerate a long operation. The remaining eight patients had been obstructed from two to six days at the time of admission and were acutely ill. Attempts at intubation failed in these patients and all were in a precarious state at the time of operation. Two had gangrene requiring resection of bowel.

The nine deaths caused by peritonitis, nearly one-third of the total fatalities, illustrate the importance of prompt surgical treatment of all obstructions with strangulation.

COMMENT

Symptoms and Signs. The diagnosis of obstruction should be considered in every patient who complains of rhythmic cramp-like abdominal pain. As a rule there is nausea and vomiting with the onset of pain, but occasionally vomiting is not an early symptom. Most patients have a bowel movement or a fecal return from an enema after the onset of pain but when the obstruction is complete there is no further passage of gas or feces.

A valuable sign of early mechanical obstruction is the increased peristaltic activity of the intestines. This is most satisfactorily determined by auscultation, whereby it can usually be demonstrated that the waves of peristaltic activity are synchronous with the paroxysms of abdominal pain.

Abdominal distention is a relatively late sign of obstruction and its absence should not retard the arrival at a correct diagnosis.

Roentgenograms are an invaluable aid in

establishing the diagnosis in the early stages of the disease. A distended segment of small intestine is commonly present at the onset of symptoms and can be recognized in the film.[13] Small amounts of gas are seen occasionally in the normal intestine of adults but rarely is there distention above the normal 2.5 to 3 cm. width and the shadows are transient. Distended small intestinal loops are commonly seen in infants up to about two years of age.[14,15] The stepladder pattern so often described as being a characteristic roentgenographic feature of small bowel obstruction is a relatively late sign, although it may be present eighteen to twenty-four hours after an obstruction becomes complete.

DIFFERENTIAL DIAGNOSIS

Large Bowel Obstruction. On the basis of symptoms alone a differential diagnosis between large and small bowel obstruction is difficult. Roentgenograms, however, will as a rule indicate the location of the obstructing lesion.

Paralytic Obstruction (Non-infectious). This is the type of obstruction commonly seen in the immediate postoperative period. On the basis of roentgen examination the differentiation between a purely mechanical and paralytic type of obstruction may not be certain. However, in most cases of paralytic obstruction there is distention of both the large and small bowel. Increased peristaltic activity is a characteristic finding of mechanical obstructions, particularly in the early stages.

Paralytic Obstruction (Infectious). Obstruction caused by local or general peritonitis is associated with the signs of infection such as fever, leukocytosis and elevation of pulse rate. Roentgenograms usually show multiple areas of distention in both the large and small bowel and enemas will, as a rule, cause the passage of some gas or feces. Pain, when present, is constant in contrast to the intermittent pain of a mechanical obstruction.

Obstruction with Strangulation. The differentiation between simple mechanical obstruction and obstruction due to early strangulation cannot be made with certainty yet early differentiation is important. There are, however, certain signs and symptoms which suggest strangulation: (1) pain which persists between the attacks of colicky pain; (2) local tenderness or a palpable mass; (3) elevated temperature, pulse and white blood count which do not return to normal after restoration of fluid balance and (4) rapid deterioration in the condition of the patient.

TREATMENT

When a diagnosis of small intestinal obstruction is made within 24 hours of the onset of symptoms, operative relief of the obstruction is the most satisfactory method of treatment.

The suspected presence of strangulation is always an indication for early operation. If the patient with strangulation is distended and dehydrated, it is advisable to spend a few hours administering fluids. In the meantime an attempt should be made to pass a tube for the purpose of relieving distention in the small intestine proximal to the strangulation. Experimental work indicates that the mortality from the peritonitis caused by strangulation may be reduced by massive doses of penicillin,[16] but this is not justification for permitting peritonitis to develop.

When a simple obstruction has been present for more than twenty-four hours, a period of preoperative preparation is indicated. Hydration should be corrected and an attempt made to deflate the small bowel by means of intubation with suction. If the tube does not pass the pylorus within a reasonable length of time, probably twelve to twenty-four hours, operation should be undertaken without further delay. A valuable maneuver in the operative management of the markedly distended patient is deflation of the small intestine by the use of a trochar and suction. This facilitates exposure of the site of obstruction and lessens the difficulties of closure of the abdominal wound.

CONCLUSIONS

1. Operative relief is the treatment of choice in early mechanical obstructions of the small intestine.

2. Small intestinal intubation is a valuable adjunct in the surgical treatment of obstructions. It is particularly useful in treating the acutely ill patient with marked distention, but in this type of case difficulty is often experienced in passing the tube beyond the stomach.

3. Dependence upon intubation may lead to a fatal outcome if the obstruction happens to be due to strangulation.

4. Roentgenographic study, properly interpreted, is the most important single factor in establishing an early diagnosis.

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OPERATIVE CHOLANGIOGRAPHY FOLLOWING CHOLEDOCHOTOMY

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OPERATIVE cholangiography was first introduced by the Argentine surgeon Pablo L. Mirizzi and published in 1931.[1] It is one of the most valuable methods of investigation in surgery of the bile ducts.

It is not claimed that operative cholangiography solves all the problems pertaining to calculosis of the main ducts or to biliary dyskinesiae. In fact, it is no more a panacea than any other known procedure but there is no doubt that it constitutes a first rate complement to clinical, pathologic and instrumental investigation.

I perform cholangiography as a systematic routine, i.e., operative radiography of the bile ducts. This is done as a rule by means of the injection of 5 to 10 cc. of lipiodol (iodized oil) into the cystic duct and occasionally by puncturing the gallbladder or the common bile duct. For cystic duct catheterization we carry out a total cholecystectomy, going from the fundus to the neck. Then, having freed the cystic duct, it is split open at the middle and, using the gallbladder for traction purposes, a cannula of 2 mm. caliber with a screw-thread end is inserted as far as 1 cm.; at this depth there will be no reflux of iodized oil. When the cystic duct is very wide, it should be secured with a double-knotted ligature, the ends of which are left long. After the iodized oil is injected, the gallbladder is removed, the cannula unscrewed, the cystic duct ligated and the roentgenogram taken. The injection should be slow, at a rate of 2 cc. per minute. A fast injection might bring about a spasm of the musculature of the sphincter of Oddi, thus suggesting the presence of a hypertonic condition which is actually absent.

INTERPRETATION OF THE ROENTGENOGRAMS

The reading of these pictures is usually quite easy; however, it can be difficult at times. When the whole of the biliary system fills up as far as the intrahepatic ramifications and the duodenum remains invisible, it means that there is an obstacle in the lower end of the common bile duct caused by: (1) hypertonicity of Oddi's sphincter, (2) Del Valle's retractile sclero-odditis, (3) calculus, concretions or gravel and (4) extrinsic compression.

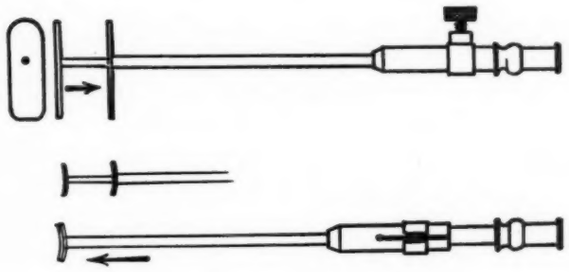
Calculi the size of a pea can be clearly seen except in a case of dilated common duct when the density of the opaque substance may overshadow that of the foreign body.

Hypertonies or spasms of Oddi's sphincter may produce the effect of "punched-out" images similar to those of calculi, but two or three roentgenograms taken at five-minute intervals show a continually changing notch characteristic of spasmodic conditions. The notch of a calculus is invariable.

An opaque filling of Wirsung's duct is a characteristic feature of hypertony of Oddi's sphincter or a retractile sclero-odditis. When the pancreatic ducts have emptied their secretion prior to cholangiography, retrograde filling of Wirsung's duct is constant.

Once the common duct has been opened and the calculi removed, the biliary duct washed with 500 cc. or more of saline in both directions by means of expression of the liver, the duct re-explored and all residual calculi removed as far as possible, the surgeon's mind is not yet at ease as the overlooking of other calculi is unhappily a

frequent happening. When they are small they may be eliminated if an endeavor is made to dilate Oddi's sphincter carefully by means of Béniqué's sounds during at least fifteen minutes and up to No. 35 of the Charrière scale. This dilatation of the sphincter prior to inserting Kehr's tube is, in my opinion, essential.



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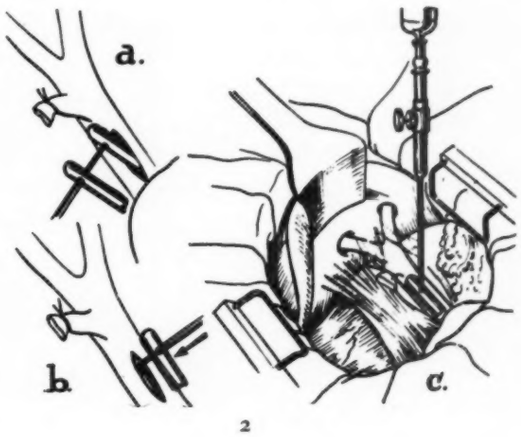

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FIG. 1. The cannula; natural size.
FIG. 2. Putting the cannula in place; (*a*) inserts one plate; (*b*) running the outside plate and (*c*) the two plates are pressed one against the other.

CONTROL CHOLANGIOGRAPHY

The surgeon will be satisfied that he has done his best to secure his patient a future free from the fear of recurrences if he can carry out cholangiography before inserting Kehr's tube and after completing all manual and instrumental investigations. It will thus be possible to discover residual calculi in sites where instruments are unable to detect them.

In 1945 I planned a simple type of injecting cannula[2] precisely for this purpose. It is quite cheap and its manipulation easily learned owing to its simplicity.*

DESCRIPTION AND MANIPULATION OF THE CANNULA

Two slightly grooved thin metal plates (20 by 6 mm.) are adapted on a telescopic type of slide 12 cm. long that can be secured at different levels by means of a screw. One of these plates is inserted in the common duct while the other remains outside. (Fig. 1.) On pressing one against the other the incision in the common duct is closed and no lipiodol runs out. (Fig. 2.) Five to 10 cc. of lipiodol are injected in approximately two minutes and then, so as to avoid a reflux, the barrel of the cannula is occluded by means of a mandrin or rubber cork. The cannula is not withdrawn

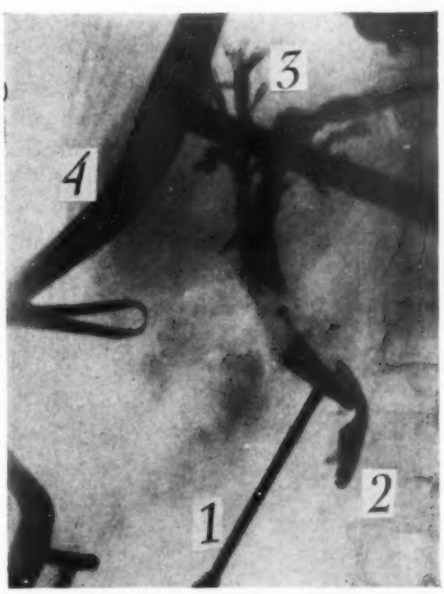

FIG. 3. Radiogram; (1) the cannula; (2) the end of the common duct, the sphincter Oddi remains closed; (3) intrahepatic branches filled with 5 cc. lipiodol and (4) a branch of the spreader.

* At this writing this cannula can be obtained only at Lutz Ferrando & Co., Florida 240, Buenos Aires, Argentina.

for the roentgenogram. The apparatus is made of a rustless material.

On seeing these excellent radiographic pictures of the biliary ducts refilled with lipiodol (Fig. 3) it is easy to realize how clearly the irregularities that may still remain in the lumen of the ducts can be detected and it is possible to localize residual calculi within the main ducts or the intrahepatic ramifications. Having taken at least two roentgenograms at five-minute intervals the instrument is withdrawn if no calculi are found, excess lipiodol is aspirated and Kehr's tube fixed *in situ*. The entire procedure can be completed in roughly ten minutes.

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In chronic constrictive pericarditis the left heart chambers are often markedly constricted. This can be ascertained by cardiac catheterization which will show, in such cases, that the pulmonary blood pressure is distinctly elevated. Mitral stenosis when present produces an almost identical syndrome on the right heart, causing marked elevation of the pulmonary circulation. Clinically, patients with chronic constrictive pericarditis usually present an accentuated pulmonary second sound, enlarged heart, deviation of the electrocardiographic axis to the right and a condition of chronic congestion that is constantly present. In such cases surgery may often be of benefit. As much as possible of the adherent and thickened pericardium must be removed (partial pericardiectomy). (*Richard A. Leonardo, M.D.*)

INTRAPERITONEAL DRIP IN PRESENCE OF ABDOMINAL INFECTION*

EXPERIMENTAL STUDY

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THE parenteral administration of fluids in surgical conditions is a firmly established procedure. Of the various methods such as venoclysis, hypodermoclysis, intra-arterial route, proctoclysis and intra-osseous infusions only the first two have gained popularity.

Venoclysis has proven its value but has definite limitations and drawbacks. Technical obstacles may be encountered in locating or entering the vein if the latter is small as in infants, collapsed as in shock, thrombosed due to repeated infusions or difficult to locate as in obese individuals; under such circumstances repeated attempts to enter a vein are annoying to sensitive patients. If the needle slips out of the vein and the mishap is not noted promptly, a painful subcutaneous accumulation of fluid may result. The main disadvantage of venoclysis is the necessity of immobilization of one of the patient's extremities. This prohibits free movements essential for prevention of postoperative thrombosis and pulmonary embolism, contributes to the patient's discomfort and may interfere with his night's rest if the infusion cannot be completed before bedtime.

Hypodermoclysis is painful, the fluids are very slowly absorbed in the presence of a circulatory collapse and free movements of the patient's extremities are limited not only during the procedure but also for some time afterward because the patient is reluctant to move limbs distended with fluid.

Such drawbacks of venoclysis and hypodermoclysis justify consideration of an additional route for parenteral infusion of fluids.

It occurred to the authors that the intraperitoneal route may be used for replacement therapy in selected cases, especially after celiotomy. It was planned to administer the fluids through tubing inserted into the abdominal cavity just before the closure of the peritoneum. Thus the patient would preserve the freedom of movements of all his extremities, could change his position at frequent intervals and would require less supervision than a patient given fluids parenterally by one of the customary methods.

The intraperitoneal route has been recommended by numerous authors,[1–10] chiefly pediatricians, for introduction of various fluids such as saline or dextrose solution, blood, etc. The method lost its popularity because (1) on some occasions certain fluids, especially saline solution, produce irritation of the peritoneum, (2) there is a potential danger of infection, (3) there is danger of injury to the intestines by the needle and (4) the use of fontanels, scalp veins, etc., is considered more satisfactory.

It appeared to the authors that three essential modifications of the intraperitoneal route might make the method practical. The danger of inadvertently piercing a hollow viscus can be overcome by inserting a soft rubber catheter into the abdominal cavity before closure of the peritoneum. The employment of anti-

* This study was supported by a grant from the Abbott Laboratories, North Chicago, Illinois, which also supplied the fluids and antibiotics used in the experiments

biotics in addition to strict observance of asepsis technic should reduce the possibility of infection to an insignificant degree. The replacement of a massive infusion by a slow drip should avoid the irritation of the peritoneum and the discomfort created by a rapid distention of the abdomen.

Experiments on rabbits and dogs[11] demonstrated the practicability of the intraperitoneal drip. Three facts have been established, namely, the absorption rate of 5 per cent dextrose or physiologic saline solution with or without addition of vitamin mixtures was such as to allow introduction of ample fluid to meet body needs; minor fibrinous deposits around the tubing or attachment of the omentum to it did not interfere with repeated injections given on several consecutive days or even at intervals of one to two days, and the intraperitoneal drip did not provoke any infection as proved by postmortem findings and bacterial cultures.

Theoretical considerations suggested several contraindications to the intraperitoneal drip, such as ascites, disseminated metastases of malignant lesions, general peritonitis and extensive postoperative adhesions.

To define the field of usefulness of the intraperitoneal drip after celiotomy it became necessary to investigate the question as to whether or not circumscribed inflammatory processes such as appendicitis, cholecystitis and salpingitis should be considered contraindications to the employment of the method. To study this problem experimentally a local peritonitis was produced in dogs by tying the cecal pouch under aseptic conditions and fluids were administered intraperitoneally in the form of a drip on three successive postoperative days.

Methods. The experiments were carried out upon healthy mongrel dogs ranging in weight from 6.3 to 14 kg. Under aseptic conditions the cecal pouch was exposed and ligated with a double ligature of umbilical tape after severing the blood vessel. Before closure of the peritoneum either a rubber tubing, size ten, or a tubing made of vinyl resin and called tygon, 3.06 mm. (0.120 inch) or 0.69 mm. (0.027 inch) internal diameter, was inserted into the pelvic cavity. Twenty-four hours were allowed for the necrosis and resulting infection to develop. Intraperitoneal infusions were started on the first postoperative day and were repeated on two successive days using 45 cc. per kilogram body weight. The following solutions were used for the drip, namely, physiologic saline in four dogs, 5 per cent glucose in distilled water in three dogs and 5 per cent glucose in physiologic saline solution in one dog. Concurrently with each intraperitoneal drip an injection of 150,000 units of procaine penicillin-G in oil was given intramuscularly. Six dogs served as control and were given an injection of 150,000 units of penicillin on the first, second and third postoperative days. All animals were sacrificed on the fifth postoperative day and a postmortem was performed.

Results. The autopsy findings in all six control dogs were practically identical. The tied segment of the cecum became necrotic and sloughed off causing peritonitis. Although the process was confined chiefly to the adjoining portions of the ileum, cecum and ascending colon which were adherent one to another, there were fibrinous deposits on other portions of the small intestines and a small amount of purulent exudate in the vicinity of the necrotic segment. The omentum was moderately congested.

None of the eight dogs which were given intraperitoneal drip died within the first five postoperative days. The autopsy findings were practically identical in all dogs, namely, a local peritonitis in the region of the ligated cecum, a slight congestion of the omentum and no exudate. The type of the solution used, viz., physiologic saline, glucose in saline and glucose in distilled water appeared to be of no importance as far as the intensity or the extent of the inflammatory process was concerned.

On the whole, the changes found in the

abdominal cavity of dogs that were given fluids intraperitoneally by the drip method were either equal to or less pronounced than those in the control dogs.

COMMENTS

In analyzing the results of this study it is important to call attention to several facts. The presence of local peritonitis did not interfere with the flow of fluid in a single instance in spite of the fact that the tip of the tubing was located in the vicinity of the local inflammatory process where fibrinous deposits, the plastic exudate and adhesions might be expected to obstruct the outlet.

The animals given the intraperitoneal drip remained in as good or better condition than the control dogs throughout the duration of the experiments. The autopsy findings showed that the drip did not intensify the local process or contribute to its spread. As a matter of fact, two of the control animals had a relatively large amount of hemopurulent exudate. A smaller collection of exudate of a purely hemorrhagic character was found in one dog which was given the intraperitoneal drip. The remaining seven dogs had no exudate.

It is believed that these data suggest that the presence of local infectious processes within the abdominal cavity should not be considered a contraindication to the intraperitoneal drip and that this route can be used for postoperative replacement therapy in patients having a temporary deficiency of water, electrolytes or both.

In the presence of local peritonitis it is probably advisable to supplement the intramuscular administration of penicillin by addition of the drug to the solution used for the intraperitoneal drip, in order to obtain a higher concentration of the drug at the site of infection.

Of the bacterial irritants responsible for peritonitis in man the commonest is Bacillus coli with the streptococcus a close second. Less frequent are the staphylococcus, pneumococcus, gonococcus, etc. In view of this fact intramuscular injections of a drug acting primarily upon the gram-negative organisms, such as streptomycin, may be preferable to those of penicillin when intraperitoneal drip is given. Penicillin's chief limitation is its destruction by penicillinase which is produced mainly by organisms of the coliform group.

It is superfluous to emphasize that the presence of a localized inflammatory process within the peritoneal cavity is no excuse for neglecting the rules of asepsis in instituting the intraperitoneal drip.

The assumption is justified that an absolutely aseptic technic of the intraperitoneal drip should practically preclude the occurrence of peritonitis. However, even the remote possibility of this complication stresses the necessity of a strict observance of all rules of asepsis.

SUMMARY

1. Local peritonitis was produced in fourteen dogs by ligating the blind end of the cecum and interrupting the blood supply. Penicillin was given postoperatively. Intraperitoneal drip of physiologic saline solution, 5 per cent glucose in saline or 5 per cent glucose in distilled water was administered after the operation on three successive days.

2. The local peritonitis did not create a mechanical obstacle to the drip.

3. Neither the local nor the general condition of the dogs was aggravated by the intraperitoneal drip.

4. The results suggest that postoperative intraperitoneal drip is not contraindicated in presence of local infectious processes within the peritoneal cavity.

Acknowledgment: The authors wish to express their gratitude to Dr. Warren H. Cole, Head of the Department of Surgery, University of Illinois College of Medicine, for his valuable suggestions and the privilege of using the departmental laboratory.

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Many of us are prone to look upon bleeding from the nipples as indicating a likely malignancy of the breasts especially involving one or more of the excretory ducts. However, such is often *not* the case. It was recently shown by Volterrani that general localized or functional disturbances (neurosis, vicarious menstruation, menstrual hyperemia, purpura, hemophilia, arteriosclerosis, tabes dorsalis, localized trauma) may cause this symptom. Other lesions that might cause bloody drainage from the nipples are localized areas of inflammation and degeneration, especially chronic cystic mastitis or cystic degeneration of the excretory ducts of the involved breast. However, intracanalicular neoplasms, benign or malignant, are probably the most common lesions causing nipples to bleed. (*Richard A. Leonardo, M.D.*)

ANESTHESIA WITH BILATERAL INTERCOSTAL NERVE BLOCK*

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Baltimore, Maryland

IN 1940 Bartlett[1] first described the use of bilateral intercostal nerve block to produce surgical anesthesia for upper abdominal procedures in the very poor risk patient. After reviewing the anatomy of these nerves he concluded "the site of election for injection of the anesthetic agent is in approximately the midaxillary line where the nerve, lying at the lower border of the rib and between the two intercostal muscles, is most easily accessible and where the lateral cutaneous branch of the nerve supplying most of the external abdominal oblique muscle will be included in the block."

To facilitate bowel manipulation and intestinal handling and to spare the patients the pain of these maneuvers, a light gas anesthesia was administered. With this technic Bartlett was able to obtain satisfactory anesthesia for upper abdominal surgery in seriously ill patients whom he believed should not be given spinal anesthesia or ether.

Evans[2] has reported satisfactory anesthesia in poor risk patients with this combination of bilateral intercostal nerve block and nitrous oxide analgesia. In addition he studied the effect of bilateral intercostal nerve block combined with sodium pentothal anesthesia upon forty-five patients in clinical shock, both mild and severe, on whom abdominal exploration was done because of perforating abdominal wounds or a ruptured viscus from external trauma.

In this work done during the last war Evans did not avail himself of the anesthetic armamentarium at hand but worked under the handicap of using only those drugs ordinarily found at the battle front; even the use of oxygen was discontinued. He concluded that the anesthesia was both safe and satisfactory in this type of patient and recommended its use by the armed services.

Belinkoff[3,4] has used sodium pentothal, nitrous oxide, cyclopropane and ether to complement or balance bilateral intercostal nerve block anesthesia with satisfactory results.

The work of these men has given us excellent examples of what Lundy[5] has termed "balanced anesthesia." This does not mean using everything at hand to produce anesthesia regardless of the patient's physical and mental status. It does mean the judicious use of a combination of agents or technic or both, with specific purposes in mind, to provide a satisfactory operative field for the surgeon, to alter the patient's physiology as little as possible, to provide relief from pain and to have the patient awake as soon as possible. Too often surgeons and anesthesiologists believe that the anesthesia was poor if a second or even a third agent is employed. We do not agree with this belief.

We have used bilateral intercostal nerve block anesthesia in six poor risk patients for whom we believed this was the technic of choice.

TECHNIC

The arms are abducted and placed upon arm boards. Both mid-axillary areas are given a surgical clean-up. The procaine solution is made by mixing 5 cc. of a 20 per cent procaine solution, 70 cc. of distilled water and 5 m. of epinephrine, thus producing a 1.5 per cent procaine solution.

A 1½ or 2-inch 22-gage needle is inserted

* From the Department of Anesthesiology, Sinai Hospital, Baltimore, Md.

in the mid-axillary line perpendicular to the skin at the posterior border of the rib. After the lower border of the rib has been felt, the direction of the needle is changed so that it points cephalad; and the needle is advanced 3 to 4 mm. into the costal groove. The nerve, artery and vein lie closely together in this area and careful aspiration should be done before the procaine is injected. Four to five cc. of the 1.5 per cent procaine are deposited in the costal grooves of the sixth, seventh, eighth, ninth, tenth and eleventh intercostal nerves. Approximately ten minutes should be allowed for the anesthesia to become effective.

CASE REPORTS

CASE I. A frail, eighty-three year old male with an inoperable carcinoma of the esophagus had a gastrostomy done under bilateral intercostal nerve block and nitrous oxide anesthesia.

CASE II. A poorly nourished, dehydrated, thirty-nine year old female developed jaundice and a marked elevation of temperature following cholecystectomy. Bilateral intercostal nerve block and 450 mg. of sodium pentothal provided satisfactory anesthesia for a choledochostomy and choledocholithotomy.

CASE III. A fifty-seven year old male with a history of prolonged and severe asthma was admitted with exquisite right upper quadrant pain radiating to the back, and a board-like abdomen. The patient was sitting up in bed gasping for air; cyanosis was generalized in spite of nasal oxygen. A bilateral intercostal nerve block from T 6 to T 11 was performed and helium and oxygen were administered under positive pressure using a closed circle filter absorption system. A perforated gastric ulcer was found and closed with great dispatch. Upon his return to the ward the patient was placed in an oxygen tent. He made an uneventful recovery.

CASE IV. E. P., a sixty-four year old white female, was admitted January 8, 1947, with severe right upper quadrant pain associated with nausea and vomiting. A satisfactory history could not be obtained. The patient claimed a long-standing bronchitis and said she had been taking digitalis. On admission her temperature was 103.8°F., her pulse 100 and respirations 30; her blood pressure was 150/90. The patient was in acute distress. The respirations were rapid and labored, the nail beds and lips were cyanotic and the sclera were icteric. There was marked tenderness in the right lower quadrant where a well defined, elongated mass could be palpated. Upon examination of the chest the lungs revealed dullness and a decreased transmission of breath sounds at the left base; the heart was enlarged to the anterior axillary line with a harsh systolic blow being heard all over the precordium. The laboratory studies showed 1 plus bile in the urine; red blood cells, 4,800,000; and white blood cells, 9,200 with 92 per cent polymorphonuclear leukocytes.

The impression was hydrops of the gallbladder, pneumonia of the left base and arteriosclerotic cardiovascular disease.

Under bilateral intercostal nerve block anesthesia the abdomen was opened through an upper right rectus incision. Hydrops of the gallbladder was found and a cholecystostomy done. The patient received 500 cc. of citrated blood and 500 cc. of glucose in normal saline solution in the operating room and was returned to her room in good condition. Thirty minutes later signs of pulmonary edema were present. In spite of intensive therapy the patient died January 10, 1947.

CASE V. H. H., a sixty-two year old white male, was admitted on January 15, 1947, with sharp pain in the right upper abdomen and subscapular region of three days' duration. Marked anorexia was present. The patient had been hospitalized in November, 1945, because of left sided hemiplegia and in May, 1946, because of bromide poisoning.

Upon admission the patient's temperature was 102.2°F., the pulse 100 and respirations 28 per minute. The blood pressure was 150/80. The skin had an icteric tint. A residual left sided weakness was present and a few crackling rales were heard in the right base and right axilla. The blood count showed the following: red blood cells, 4,680,000; hemoglobin, 13.9 per cent; and white blood cells, 16,100 with 82 per cent polymorphonuclear leukocytes.

During the next few days the patient's temperature went to 106°F. accompanied by severe shaking chills. The patient became very jaundiced, the blood pressure dropped and the heart sounds became poor in quality. Electrocardiogram studies suggested myocardial infarction; but because acute biliary disease was

present, the patient was operated upon January 19, 1947. However, a bilateral intercostal nerve block was inadequate because the peripheral portion of a long subcostal incision extended beyond the zone of anesthesia. Cyclopropane and curare were used to supplement the nerve block. The operative findings were as follows: a gangrenous gallbladder surrounded by an abscess, a single large stone in the ampulla of the gallbladder, the gallbladder and biliary passages filled with blood clots, and hepatitis. A cholecystostomy, cholecystolithotomy and a choledochostomy were performed.

The patient did well postoperatively. Electrocardiograms proved that a myocardial infarct had also been present. The patient was discharged March 12, 1947.

Case VI. B. C. was a sixty-five year old white male with signs of extensive myocardial damage. On April 28, 1947, a colostomy had been done. On September 4, 1947, the colostomy was revised under bilateral intercostal nerve block and 150 mg. of sodium pentothal. However, the patient died September 6, 1947, because of peritonitis and renal insufficiency.

COMMENTS

In our brief series of six cases we found that blocking the intercostal nerves bilaterally from T 6 to T 11 at the midaxillary line with 1.5 per cent procaine provided satisfactory anesthesia for upper abdominal surgery in selected poor risk patients. We also observed that sodium pentothal, nitrous oxide or cyclopropane in small quantities obliterated the patient's perception of intra-abdominal manipulation, thus proving the advantages of "balanced anesthesia."

Since these patients were very ill, we deemed it inadvisable to use inhalation, intravenous or spinal anesthesia *per se*. Except for the patient who had pulmonary edema and expired because of either cardiac failure or too much fluid or both, these patients withstood surgery and anesthesia very well. Therefore, we believe that more use should be made of "balanced" bilateral intercostal nerve block anesthesia for upper abdominal surgery in the seriously ill patient.

CONCLUSION

In six gravely ill patients we observed that balanced bilateral intercostal nerve block anesthesia was satisfactory for upper abdominal surgery.

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Streamlined Articles

SPLENECTOMY FOR IDIOPATHIC THROMBOCYTOPENIC PURPURA

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Los Angeles, California

IN this paper five cases in which splenectomy was performed for idiopathic thrombocytopenic purpura are reported. Three of the patients were operated upon during remissions and two during acute exacerbations of the bleeding. As the complications and mortality are higher in surgery during the acute exacerbations, a plea is made for early splenectomy. Certain points in the diagnosis are emphasized and the importance of a meticulous search for the presence of accessory spleens at the time of surgery is stressed.

* * * *

The diagnosis in all cases of thrombocytopenic purpura is usually made by the hematologist. However, as splenectomy falls to the lot of the surgeon, it should be his responsibility to know the more important findings that lead to a differential diagnosis in this condition. The essential points in arriving at a diagnosis are a history of purpura or bleeding, low platelet counts, delayed clot retraction time and bone-marrow studies. (Fig. 1.)

Bone-marrow studies give the most accurate information in establishing the cause of the platelet deficiency. The marrow used for study is obtained by sternal puncture, smears being made of the fresh material and examination made immediately by the hematologist. The megakaryocyte or giant bone marrow cell is the forerunner of the blood platelets and in the normal marrow they may be counted and studied. Dameshek[1] has shown that in true thrombocytopenic purpura the megakaryocyte count of the marrow smears may be increased or may be normal in numbers, but the platelet-forming elements are decreased and the formed platelets are immature and defective in character. There is evidence accumulating that would lead to the belief that in idiopathic thrombopenic purpura, although the platelet count may be near normal, the platelets in the circulating blood are defective. The importance of bone-marrow studies to the surgeon is that he can be sure he is performing a splenectomy for purpura in which the spleen is inhibiting normal platelet formation and not for purpura in which the bone marrow is affected by some secondary or systemic cause.

CASE REPORTS

CASE 1. F. B., a ten year old male, was admitted to the Surgical Service of the U. S. Naval Hospital, September 10, 1945, with a diagnosis of idiopathic thrombocytopenic purpura. He had been under observation on the pediatric service for four months. The following history was elicited from his mother: The patient bruised easily and large black and blue spots appeared frequently on his arms and legs. He had been afflicted with frequent nosebleeds for two years. In 1943 the patient had a tonsillectomy which was followed by severe bleeding that required a transfusion. On physical examination the patient was a normally developed and nourished male, with several large areas of ecchymosis on the lower extremities. The spleen was not palpable. The tourniquet test was positive; the remainder of the physical examination was negative. The

red blood count was 4,280,000, the white cell count 4,900 and the hemoglobin 84 per cent. The platelet count was 84,000, with a coagulation time of two minutes and fifty seconds, a bleeding time of three minutes and forty-five seconds and a clot-retraction time of over twenty-four hours. The spleen was removed and the platelet count was normal within forty-eight hours. At the time of discharge from the hospital on the ninth postoperative day the platelet count was 266,000 and clot retraction was complete in four and a half hours. This patient was seen in the clinic four months later and had a normal platelet count and no recurrence of symptoms.

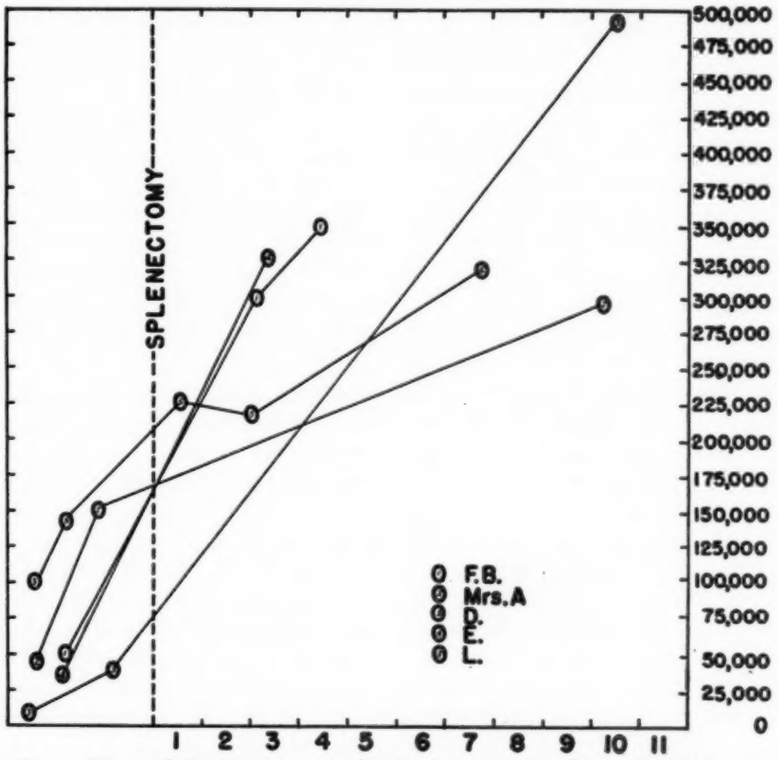

FIG. 1. Chart of platelet count studies in three acute and two chronic cases of idiopathic thrombocytopenic purpura; in all cases the platelet count was elevated to normal within four days following splenectomy.

CASE II. Mrs. J. A., a forty-five year old female, was admitted to the Surgical Service of the U. S. Naval Hospital, August 27, 1945, with a diagnosis of idiopathic thrombocytopenic purpura made by her family physician. This patient stated that in 1942 she had first noticed a considerable increase in her menstrual flow. A diagnostic curettage was negative for any pathologic condition. Radium was used without any benefit. Six months prior to admission she noticed the appearance of large black and blue spots on the arms and legs following slight trauma. Blood studies by the family physician were repeatedly low for platelet counts. On physical examination the patient was a normally developed and well nourished female, with numerous petechia and ecchymotic spots on the body. The largest areas were on the left arm and leg. There was a small area of purpura over the right eye. The spleen could not be felt. The tourniquet test was positive; the remainder of the physical examination was negative. On vaginal examination the uterus was small, the tubes and ovaries were palpable and there was no blood present in the vagina. The blood pressure was 136/80; the red blood count 3,800,000, the white cell count 6,800 and the hemoglobin 78 per cent. The platelet count was 78,000, the clotting time one and a half minutes, bleeding time ten minutes and clot-retraction time twenty-four hours. The spleen was removed and subsequent platelet counts showed a return to normal. On the day of discharge from the hos-

pital the platelet count was 700,000, the coagulation time one and a half minutes and clot retraction was complete in thirteen minutes.

CASE III. E. D., a nineteen year old male, was admitted to the Medical Service of the U.S. Naval Hospital, August 21, 1945, because of severe gastrointestinal bleeding of one week's duration. On physical examination the patient was a normally developed and nourished male, with visible evidence of severe anemia. There were many purpuric spots over the body. The spleen was not palpable. The tourniquet test was positive. The bleeding time was one and a half minutes, with a clotting time of three and a half minutes and no clot retraction in forty eight hours. There were no platelets seen on several blood smears. During the following four days the patient was given transfusions totalling 3,500 cc. without any apparent change in the bleeding. The platelet counts were the following: On the first day, 10,000; the second day, 18,000; the third day, 42,000 and the fourth day, 48,000. On the fourth hospital day the patient was suddenly seized with a severe headache in the occipital region and developed signs of intracranial hemorrhage. There was marked weakness of the facial muscles on the right side and paralysis of the right upper extremity. A splenectomy was done immediately. On the sixth postoperative day the platelet count was 484,000 and all symptoms of bleeding had disappeared. On September 15, 1945, the patient was returned to surgery and a large blood clot was removed from the region of the occipital lobe. The patient made a complete recovery.

CASE IV. R. E., a twenty-two year old male, was admitted to the Medical Service of the U.S. Naval Hospital September 6, 1945, complaining of a severe nosebleed and large black and blue spots over the body. The patient stated that he had been subject to nosebleeds all his life; four weeks previous to admission they had become more frequent and more difficult to stop. On physical examination there were numerous areas of ecchymosis over the surface of the upper and lower extremities. The spleen could not be felt. The tourniquet test was positive; the remainder of the examination was negative except for some bleeding from the nose. The red blood count was 3,100,000, the white cell count 5,100 and the hemoglobin 67 per cent. The bleeding time was thirty minutes, clotting time ten minutes and fifty-three seconds and the platelet count 61,000. On the day following admission the patient developed a weakness of the facial muscles on the right side and evidence of an intracranial hemorrhage in the left motor area. A splenectomy was performed at once. On the second postoperative day the bleeding time was six and a half minutes, clotting time two minutes and thirty-five seconds and the platelet count 326,000. On the fourth postoperative day a large subdural hematoma was removed from the left temporal region. The patient returned to duty three months later, completely recovered.

CASE V. L. L., a five year old female, was admitted to the Surgical Service of the U. S. Naval Hospital August 6, 1945, with a diagnosis of idiopathic thrombocytopenic purpura. She had been under the observation of the pediatric service for a year. In the history which had been obtained from the mother there was a tendency to bleeding and easy bruising since birth. Numerous blood studies over this one-year period revealed platelet counts as low as 60,000. The usual conservative methods of treatment had failed to relieve the symptoms or to raise the platelet counts. On physical examination the patient was normally developed and nourished and there were many purpuric spots over the body, especially the lower extremities, the arms and over the right eye. The blood pressure was 100/60; the spleen was not palpable. The tourniquet test was positive. The remainder of the physical examination was negative. The red blood count was 3,000,000, the white cell count 16,000 and hemoglobin 70 per cent. The platelet count was 102,000, the coagulation time four minutes and ten seconds, the bleeding time nine minutes and fifty-two seconds and the clot retraction was slight in forty-eight hours. Splenectomy was performed. The platelet count rose and on the eighth postoperative day the count was 320,000, the coagulation time three minutes and ten seconds, bleeding time one minute and fifty-five seconds and clot retraction complete in six hours. The pathologic report of the spleen was: The consistency of the spleen, measuring 8 by 6 by 3 cm., seemed softer than normal. On section the pulp was mush and numerous white bodies, apparently malpighian bodies, were seen. On microscopic section there was marked hyperplasia of the follicles due to an increase in the reticulum cells. Scattered megakaryocytes were present. The

sinusoids were lined by large macrophages with red blood cell phagocytosis.

COMMENTS

The safe time for splenectomy in idiopathic thrombocytopenic purpura is during the periods of remission as the mortality is lower and the surgeon can make a more careful search for the presence of accessory spleens. In cases of acute idiopathic thrombocytopenic purpura the development of signs of intracranial hemorrhage is a very serious omen. In the light of new present knowledge of this condition it would seem better judgment in the handling of the acute cases to perform a sternal puncture for diagnostic purpose and remove the spleen early, using transfusions after surgery, rather than to rely on blood as a means of therapy.

Recent work by Curtis[2] and his associates seem to indicate that there is a more common prevalence of accessory spleens than has been previously suspected by surgeons. If this is true, and further work will be necessary to corroborate these findings. remissions in thrombocytopenic purpura may be explained on this fact. A careful search by the surgeon at the time of laparotomy for the presence of accessory spleens may be a step in the direction of lowering the percentage of recurrences. As many as twenty to thirty accessory spleens have been reported in a single case.

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AMEBIASIS IN SURGICAL PATIENTS*

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AMEBIASIS is well recognized as a disease which is not confined to tropical countries. However, the incidence of the disease is much higher in people who have spent some time in endemic areas. In World War II the Pacific Islands, the Mediterranean area, India, Burma and China were found to be endemic areas. Individuals who saw service in these areas were definitely more likely to have the disease than others.

Because pain is the most common symptom of amebiasis, it is most frequently confused with surgical disease of the abdomen. A diagnosis of chronic or subacute appendicitis should not be made unless a negative stool examination for ameba has been obtained. The indication for stool examination for parasites may well be expanded to include all vague abdominal complaints.

Unsuspected and untreated amebiasis forms a serious complication to surgery of the bowel. It may result in a prohibitive mortality. It is therefore recommended that stool examination for parasites be done on all patients who are being prepared for surgery of the bowel.

* * * *

Immediately after the end of World War II a marked increase in the number of patients with amebiasis was noted in this hospital. The incidence was so great that the admission rate approximated one new patient per week. Now, four years after the end of the war, amebiasis again has become a relatively uncommon problem. The large number of cases in the postwar period, however, supplied an excellent opportunity for a study of the disease. One hundred consecutive patients with amebiasis admitted and treated in the Veterans Hospital, Lincoln, Nebraska, are the subject of this study. Eighty-five per cent of the cases occurred in World War II veterans. Only 25 per cent of these patients had been hospitalized for diarrhea while in the service. Most of the amebiasis, however, was found in veterans who had served in endemic areas; 35 per cent had served in the Pacific theater and 15 per cent had seen service in the Mediterranean or the China-Burma-India theaters. On the other hand, 34 per cent of the patients had served in temperate or subarctic areas.

The outstanding symptom of amebiasis was discovered to be abdominal pain. Seventy-one per cent of the patients complained of abdominal pain which was crampy in character, chronic in nature and variable in severity. Thirty-one per cent of the patients stated that the pain was either most severe in or confined to the right lower quadrant. Diarrhea was complained of in 51 per cent of the cases. The typical syndrome of amebiasis was therefore found to be chronic abdominal pain, chronic in nature, usually in the right lower quadrant but possibly elsewhere over the course of the colon. The white count may be normal or slightly elevated. Because of this combination of symptoms confusion with appendicitis may develop. In this group of patients it was significant that fully 27 per cent were referred to the hospital for appendectomy.

Seventeen per cent of these patients were diagnosed as having some form of colitis. This diagnosis must be recognized as non-

* From the General Surgical Service of the Veterans Hospital, Lincoln, Nebr. Sponsored by the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are a result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

specific in nature. Stool studies for ameba established an etiologic agent and specific treatment could then be ordered. Five per cent of these patients were admitted for hemorrhoids or rectal bleeding. It should be emphasized that rectal bleeding which cannot be explained by proctoscopic examination as well as cryptitis and proctitis should have stool examination for ameba. Amebiasis will occasionally result in massive rectal hemorrhage which is, however, usually self-limited.

There were three patients in this group who had tumors of the colon and rectum complicated by amebiasis. It is easy to overlook amebiasis when carcinoma of the colon is discovered. It is suggested that routine stool studies be done on all patients with a colon condition which requires operative treatment. A major surgical procedure in the face of unsuspected amebiasis may well have disastrous results. A stool examination in such patients would seem to be a simple form of insurance against complications produced by ameba.

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Birath et al. studied twenty-six patients who had had pneumonectomies or lobectomies two to thirteen years previously. All but three were able to work regularly. All developed a little postoperative dyspnea but after a while this decreased or even disappeared. However, overdistention of the remaining lung tissue may eventually lead to mild emphysema in some cases. The follow-up results were, therefore, very satisfactory. (*Richard A. Leonardo, M.D.*)

CONGENITAL DUODENAL OBSTRUCTION DUE TO ATRESIA OF THE DUODENUM*

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CONGENITAL duodenal obstruction usually causes vomiting within a few hours after birth. The vomiting may be projectile and the vomitus may contain bile if the obstruction is below the biliary papilla. The infant may pass stools grayish in color or resembling normal meconium. However, normal meconium contains squamous epithelium which is ingested with amniotic fluid in addition to epithelial debris from the intestinal mucosa. The squamous epithelium is derived from desquamated fetal skin. Farber† suggested examining the stool for cornified epithelial cells. Absence of these cells is presumptive evidence of congenital occlusion of the digestive tract. As in this case, when obstruction is complete, x-ray examination shows a distended stomach and no gas in the intestines. Partial obstruction causes symptoms similar to these if the lumen is extremely small.

Enterostomy for feeding has been tried a few times. It practically never helps. Continuity of the gastrointestinal tract must be established if the infant is to survive. Water, salt, glucose and protein (plasma or amino acid solution) should be given to overcome the effects of the vomiting. The stomach should be aspirated and lavaged. At operation the nature of the obstruction should be identified if possible. If the obstruction is due to a band, the surgeon must be certain that no major vessels such as the superior mesenteric lie in the band. When the duodenum ends as a blind pouch, duodenojejunostomy or gastrojejunostomy may be performed. If the duodenum is continuous but dilated above a given point and very narrow below it, a transverse membranous septum must be suspected. The duodenum may be opened and the septum excised with scalpel or cautery. If the remaining lumen appears inadequate, gastrojejunostomy is required. Before concluding the operation the intestine should be traced down to the rectum to exclude congenital occlusion or obstruction of the gut lower down since congenital malformations are frequently multiple. Such instances have been described.

* * * *

Successful operations for complete congenital duodenal obstruction have been reported with increasing frequency. The author has found twenty-four such cases in the literature. In twenty-one cases either anterior or posterior gastrojejunostomy or duodenojejunostomy were done; in two cases bands were divided. Other types of operation have not been successful. Follow-up examinations were reported in twenty cases from two months to eleven years after operation; all of the patients were in satisfactory condition. The following is a report of a case in which gastrojejunostomy was done and in which a follow-up x-ray examination after thirty months showed satisfactory function.

CASE REPORT

R. L., a male, born March 28, 1944, weighed 5 pounds 6½ ounces and appeared to be one month premature. Meconium stools were passed on March 29th. Projectile vomiting began on March 30th and jaundice developed. X-ray examination after barium was given through a tube showed distention of the stomach and the first portion of the duodenum.

† FARBER, S. Congenital atresia of the alimentary tract. *J. A. M. A.*, 100: 1753–1754, 1933.

* From the Surgical Services of the Mount Sinai Hospital, Philadelphia, Pa.

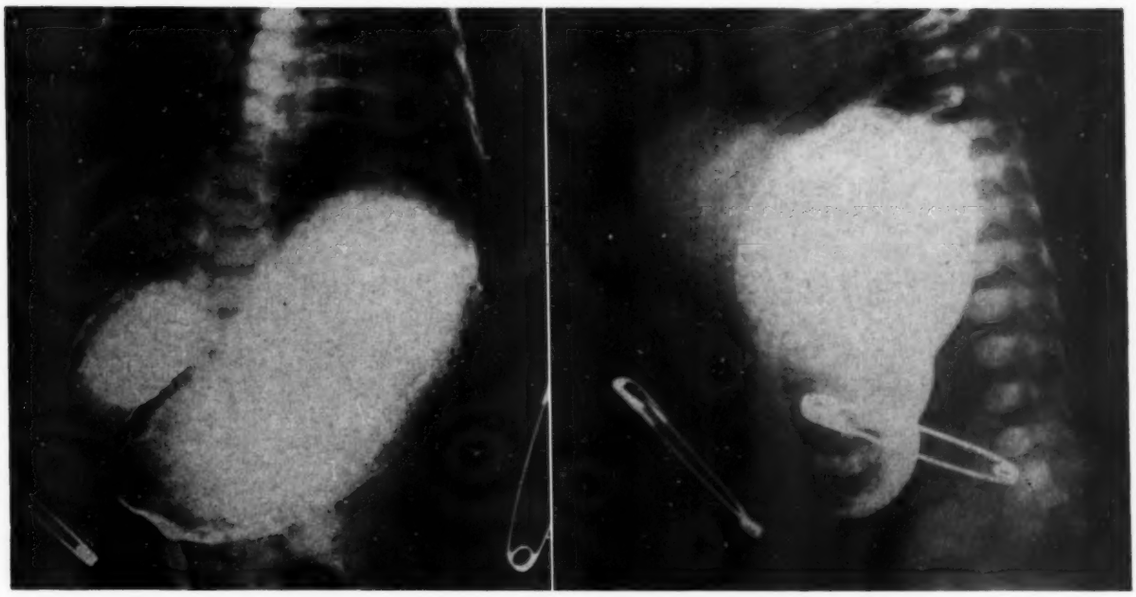

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FIG. 1. Anteroposterior view of abdomen after administration of barium; the hugely distended stomach and first portion of the duodenum almost fill the entire abdomen. Neither barium nor gas is present in the intestines.
FIG. 2. Lateral view of the abdomen made immediately after Figure 1; no intestinal filling is visible.

No barium left the stomach after three hours; no gas was present in the intestines. (Figs. 1 and 2.) After preparation with glucose-salt solution and vitamin K operation was performed on March 31st under local anesthesia.

The stomach was exposed through an upper abdominal incision. It was enormously distended and was emptied by suction through a tube passed from the mouth. The stomach ended in a blind pouch probably just a little beyond the pylorus. The small intestine was 3 to 4 mm. in diameter and appeared hypoplastic. No other intestinal anomaly was found. An antecolic anastomosis was made between the distal end of the stomach and the jejunum with fine chromic catgut, using one continuous suture line, reinforced by a few interrupted sutures. Parenteral fluids were given on the first postoperative day and feedings of breast milk were started on the second day. Occasional vomiting occurred. X-ray examination showed considerable barium in the stomach and a small amount in the small intestine. The residual barium was removed from the stomach by lavage. Temperature became and remained normal after the fifth postoperative day. The infant was discharged from the hospital on the twenty-sixth postoperative day in good condition.

A follow-up examination was made on August 16, 1945. The child appeared well nourished. X-ray examination on November 19, 1945, showed that the stomach was large and that barium left it quite slowly so that at the end of five hours a considerable residue was still present.

On October 14, 1946, the child was readmitted to the hospital for treatment of umbilical and right inguinal hernias. He appeared adequately developed for his age and in good health. X-ray examination at that time showed normal gastrointestinal motility. The hernias were repaired a few days later and inspection of the small intestine at this time showed it to be of normal caliber. Recovery was uneventful.*

* References for this article will be included in the author's reprints.

METHOD OF TREATMENT OF LATE STRANGULATED FEMORAL HERNIA*

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We believe that entero-entero-anastomosis above the strangulated loop combined with drainage of the sac is of real value in the treatment of late strangulated hernia. When there is excess drainage of the small bowel content following this procedure, the use of an inflated balloon can block off the fistula and allow bowel content to pass through the entero-entero-anastomosis and allow the fistula to heal. The procedure entails a minimum of surgery in those patients who are very poor risks. In the two patients reported complete cure was obtained by this method. In instances in which there is intraperitoneal leakage with peritonitis treatment must prevent further leakage of bowel content into the peritoneum. At present it appears that this can best be done by freeing the hernia, resecting the gangrenous loop and forming an anastomosis.

* * * *

Strangulated hernia with spontaneous perforation and fecal fistula formation is a rare lesion in surgical practice today. It is also unusual in that it entails the strangulation of a hernia with perforation into the sac and in some cases there is no peritoneal contamination. The main problem is to re-establish bowel continuity by the simplest method since most of these patients are in the older age groups with complicating vascular problems in addition to those of infection, dehydration and loss of nutrition because of the fecal fistula.

Cases of strangulated Littre's hernia involving Meckel's diverticulum have been reported. These cases, however, present a different problem in that an accessory portion of bowel is involved. The patient usually has no problem of obstruction nor is there complete loss of small bowel contents due to fistulous opening as can occur when the full circumference of both loops is involved. Haggard[2] reported five cases. In two patients the openings closed spontaneously while two required freshening of the opening with closure. In one case the loop was detached intra-abdominally and closure of the ileostomy was done. Friedman's report[3] of spontaneous closure and cure after simple incision and drainage of the sac means, of course, that the strangulation was of only a portion of the bowel. All these hernias were, therefore, of Littre's or Richter's type and did not involve the full circumference of both loops.

MacDonald[1] inserted a tube in the opening and did an end-to-side anastomosis of the ileum above. He finally closed the fistulous opening following an ileosigmoidostomy. Mulvaney[5] suggests a proximal ileostomy initially followed by end-to-end anastomosis of the ileum, shortcircuiting the impacted loop. Gatch and Montgomery[6] report two cases in which a Miller-Abbott tube was used to decompress the obstructed proximal loop. Following this decompression a transabdominal approach was done and an end-to-end anastomosis performed. These authors also mention as a suggestion entero-entero-anastomosis above the strangulation. This was the method used in the cases to be reported.

The following two cases of late strangulated femoral hernia with involvement of the entire circumference of both loops are of interest in that cures were obtained by a relatively simple surgical procedure

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which did not entail the risk of peritoneal contamination from the sac. In one of these there was no problem of loss of bowel content although the patient was obstructed and perforated. In the second case the problem of complete small bowel fistula added to the difficulty considerably and required slight modification of the treatment.

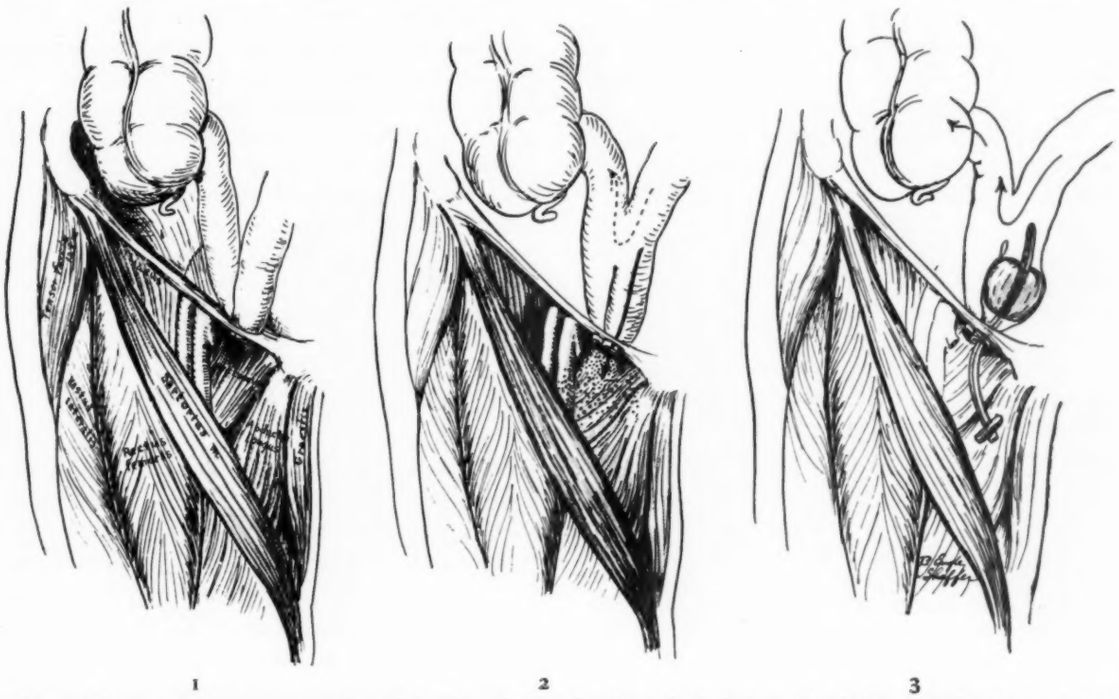

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FIG. 1. Diagrammatic representation of the situation at the time of admission; stippled portion illustrates extent of infection.
FIG. 2. Initial operative procedure which resulted in partial correction of complete small bowel fistula.
FIG. 3. Diagrammatic representation of the insertion of the Miller-Abbott tube with inflation of balloon which resulted in complete blocking of the fistula and marked improvement in the patient's condition.

CASE REPORTS

CASE 1. F. N., an eighty-three year old female, was admitted to the Philadelphia General Hospital in May, 1939. There had been a three-week history of cramp-like abdominal pain, obstipation, nausea and vomiting. A previous history of hernia on the right for the past two years was elicited. During the present illness this hernial mass had become tense and tender and there had been associated fever. She stated that she had had dyspnea and ankle edema for many years in addition to precordial pain on exertion.

Physical examination revealed an elderly, cyanotic female with a blood pressure of 234/136. There was marked cardiac enlargement; the lungs showed rales at both bases. There was marked abdominal distention with some free fluid and there was a tender, indurated, reddened mass in the right femoral region.

The patient was treated with gastric suction and intravenous fluid. Under field-block anesthesia, a Murphy button-type anastomosis was done between the distended obstructed proximal ileum entering the femoral hernia and the collapsed distal limb. There was no evidence of peritonitis. The abdomen was closed throughout with wire and the hernial sac was opened and drained, with the escape of foul pus and small bowel contents. The patient began to pass gas on the first postoperative day and the Murphy button was passed on the seventh day. There was drainage from the inguinal area for approximately one month, at the end of which time it closed spontaneously. Subsequent examinations revealed normal bowel function.

The entero-entero-anastomosis in this case immediately established normal bowel continuity and fortunately the problem of fecal fistula and infection was not great.

CASE II. J. R., a sixty-eight year old female, was admitted to the Philadelphia General Hospital in April, 1946. Two weeks prior to admission she noticed the appearance of a painful swelling in the right inguinal region and crampy abdominal pain with nausea and vomiting. Three days following the initial complaints sudden excruciating pain developed in the inguinal region which persisted to the time of admission. The painful swelling of the inguinal region had increased steadily. The patient also stated that she had noticed reddening of the skin and marked tenderness with fever.

Physical examination revealed an elderly white female who showed evidences of arteriosclerotic heart disease. The abdomen was distended but there was no rigidity or tenderness. In the area of the right femoral triangle there was a huge area of cellulitis and induration, the central portion of which was grossly gangrenous. There were several small defects in the skin through which foul brown pus was draining. Gas could be palpated in the subcutaneous tissues.

Immediately after admission the gangrenous skin and soft tissue overlying the abscess was débrided. It was found that the slough had extended down to the muscle, comprising the femoral triangle. The muscle bellies were readily identified and the femoral canal could be visualized with what appeared to be mucous membrane of small bowel within it. (Fig. 1.)

Treatment consisted primarily of restoring fluid balance and nutrition. There was free flow of feces through the spontaneous ileostomy so that no problem of obstruction was present. A catheter was placed in the enterostomy in an effort to siphon off small bowel contents from the huge area of infection. There continued to be considerable small bowel drainage which resulted in further undermining of the soft tissues. On May 2, 1946, an entero-enteroanastomosis was done between the proximal and distal limbs of small bowel entering the femoral canal. It was done through a transverse, right lower quadrant incision between the proximal and distal limbs of small bowel entering the hernia. (Fig. 2.)

Following this procedure there was some improvement. The patient began to have rather scanty bowel movements but there was considerable drainage from the spontaneous ileostomy site in the femoral region. A Miller-Abbott tube was passed into the proximal limb of the spontaneous enterostomy and the balloon was inflated. (Fig. 3.)

Following this there was no further drainage from the fecal fistula and the patient's condition rapidly improved. The Miller-Abbott tube with inflated balloon was left in the bowel for about three weeks. By this time the defect in the area of previous ulceration had shrunken markedly and the balloon was deflated and removed. Granulations about the spontaneous ileostomy had become so firm that no further drainage occurred. The patient was discharged on June 22, 1946, and subsequent follow-up has shown normal bowel function.

COMMENTS

We have treated two other patients with strangulated femoral hernia with spontaneous perforation which were complicated by peritoneal contamination. Both of these patients were subjected to a transabdominal procedure with resection and anastomosis. One of them survived for three months and died ultimately of liver abscess while the other died of peritonitis in the immediate postoperative period. Both of these patients were treated prior to the use of antibiotic therapy.

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HIGH GASTRIC ULCER

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THERE is no unanimity of opinion concerning the best treatment for high, posteriorly situated gastric ulcer; the technical procedure has been largely guided by fear of carcinoma rather than by logical deduction. The author summarizes the results of thirteen such cases, in which none of the stigmas of malignancy was present, in which patients were treated by vagotomy alone. The wounds in all thirteen cases healed promptly and have remained healed over a period of two to three years.

* * * *

In the midst of the chaos and conflict of opinion touching peptic ulcer one fact has emerged: The problem of gastric ulcer is much simpler than its duodenal prototype; gastric resection is almost never followed by debilitating secondary gastrojejunal ulceration. However, the very high ulcer with its semi-invalidism has always challenged the judgment of gastric surgeons.

From an experience of 563 gastric resections for gastric or duodenal ulcer with a mortality rate of 2 per cent, I believe in gastric resection; however, in these high ulcers a resection often means total resection and I am opposed to total gastrectomy for non-malignant lesions. Unfortunately there are no reliable criteria by which the benignity of such an ulcer may be assessed with certainty but long duration without recent symptomatic, radiologic, gastroscopic or chemical change in the presence of high acid is presumptive evidence of its benignity.

European surgeons are doing vagotomy for gastric ulcer without the same fear of compromising their position with respect to malignancy that has characterized American surgeons. Thirteen patients were selected whose ulcers were clinically benign, without stigmas suggestive of malignancy, and simple vagotomy was done in each case. All patients were warned that if any ulcer had not healed in thirty days they were to be reopened and resected.

All ulcers healed promptly; I have not had to go back and resect a single case which one would expect to do in about 10 per cent of cases. All of these cases would heretofore have had gastric resection of a high, difficult type.

This report is not designed to discourage standard procedures of gastrectomy in achlorhydric ulcers or those with suggestive stigmas of malignancy whether they are simple or benign.

Judicious selection of gastric ulcer can be 90 per cent right in the diagnosis of benignity, and I cannot help but believe that our conception of adequacy in the matter of surgical treatment of surgical gastric ulcer has been tinctured with more fear than logic. If an ulcer fails to heal in thirty days following vagotomy, it can still be resected and may not be malignant; but even if it fails to heal and in consideration of the dilatory attitude of many internists toward radical treatment, thirty days does not seem to be unduly venturesome.

Case Reports

PATENT OMPHALOMESENTERIC DUCT IN AN ADULT*

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PATENT omphalomesenteric or vitelline duct is a rare anomaly. In an exhaustive review of the literature Kittle, Jenkins and Dragstedt[1] found 128 cases recorded. They reported three of their own cases bringing the total to 131. The age incidence of this anomaly as encountered ranges from birth to twenty-eight years of age, with the greater number of cases being discovered in the first year of life. This anomaly is predominately in the male sex. Fecal discharge is the most common finding. In the older patients the discharge may be intermittent and consists of either yellow or green fluid mucus or serosanguineous exudate. Twenty-seven of the 131 reported cases were complicated by prolapse of the ileum through the patent duct. All but one of these occurred in infants ranging from birth to seven months; the other case was that of a sixteen year old boy. Omphalomesenteric duct is treated by resection at the base and dissecting out the tract in its entirety.

The purpose of this communication is to report a case of uncomplicated omphalomesenteric duct in an adult treated by resection in which a preoperative diagnosis was made only because of the curiosity of the writers in the origin of myositis surrounding the umbilicus.

CASE REPORT

A twenty-six year old white male was admitted to the Surgical Research Service of Brooke General Hospital on June 9, 1947, because of excruciating pain about the umbilicus radiating down the right groin and along the dorsum of the penis. This was associated with foul-smelling, purulent discharge from the umbilicus.

The patient apparently had been well until October, 1944, when while stationed in the Pacific area he noticed irritation of the skin about the umbilicus which resembled ringworm. There was no pain, drainage or foul odor associated with this complaint. Complete remission occurred within ten days. From 1944 to eight months prior to admission the patient remained asymptomatic. He then experienced intermittent gas pains which did not cause any great degree of discomfort but which continued until the time of admission. In April, 1947, the patient noticed the recurrence of the rash for which he had been treated in 1944. No pain or foul drainage was present. The patient states that he applied an antiseptic to the area, with almost immediate relief ensuing. On May 31, 1947, he again experienced an irritation about the umbilicus together with moderately severe pain on movement of the abdominal muscles. He also noticed for the first time a slight amount of foul, greenish drainage from the umbilicus. On June 2, 1947, he was seen by a physician who prescribed daily applications of penicillin ointment to the area. Partial relief of symptoms was obtained during the first three days. Pain recurred after this period, however, increasing in severity to include the rectus muscle segment immediately surrounding the umbilicus and radiating along the dorsum of the penis and down the inner aspect of the right thigh. The drainage gradually in-

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creased in amount with the result that the patient was admitted to the hospital for further evaluation and treatment. At no time was there any history of fecal drainage from the umbilicus and no history of nausea, vomiting, melena, bloody stools, jaundice or other gastrointestinal symptoms. Family history and past history were non-contributory.

The patient was a well developed and well nourished young white male who appeared to be in acute distress assuming a protective attitude as he endeavored to relieve the severe abdominal pain of which he was complaining. Examination of the head, neck and chest was essentially normal. There was no evidence of cardiorespiratory abnormality. Examination of the abdomen revealed a foul-smelling, greenish yellow discharge emanating from the umbilicus. The rectus muscle was extremely spastic throughout its length and was exquisitely tender on palpation in a strip approximately 10 cm. wide running transversely across the abdomen centering over the umbilicus, with its lateral limits corresponding roughly to those of the rectus sheath. There was no redness or local heat over this area. The remainder of the abdominal examination revealed no further abnormalities. There was no evidence of hernias of any type. The remainder of the physical examination was essentially normal.

The laboratory studies were as follows: red blood count, 5,500,000; white blood count, 11,400 with 80 per cent neutrophils, 16 per cent lymphocytes, 2 per cent monocytes and 2 per cent eosinophiles. Hemoglobin was 14.8 Gm. The Kahn test was negative. The urine was amber colored, clear, showed an acid reaction and the specific gravity was 1.017; no albumin or sugar was found; microscopic examination showed only four to six white blood cells per high power field. Culture of the drainage from the umbilicus revealed hemolytic staphylococcus aureus, coagulase positive, sensitive to penicillin and streptomycin.

After smears and cultures had revealed the causative organism, the patient was put on a regimen of penicillin 100,000 units intramuscularly every four hours. The pain subsided markedly after four injections; it disappeared gradually during the next seven days. After this time there was no further drainage. Penicillin was continued, however, until a total of 5,400,000 units had been given in nine days.

On the seventh day a probe was inserted into the umbilicus at right angle to the abdomen for a distance of 2.5 cm. It was then decided to investigate this tract further by injecting a contrast medium through a catheter under fluoroscopy. Inasmuch as the radiation of pain had been in the direction of the penis, it was believed that there might be present either a patent urachus or a patent vitelline duct. Under fluoroscopy the lipiodol injected through the umbilicus was seen to collect rapidly immediately behind the abdominal wall. Further observation revealed segmentation of this material and slow progress into the lumen of the bowel. There was no evidence of downward passage towards the bladder. It was noted that the ileum was in very close proximity to the abdominal wall in this area. Thus a definite diagnosis of a patent omphalomesenteric duct was established. (Fig. 1.)

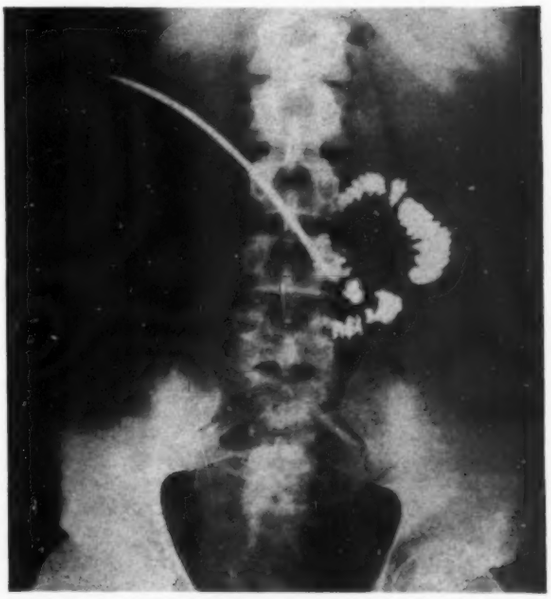

FIG. 1. Roentgenologic demonstration of the patent omphalomesenteric duct following the introduction of lipiodol through a catheter at the umbilical opening.

Extensive study of the genito-urinary system revealed no external abnormalities nor evidence of malformation of the bladder, ureters and kidneys by cystograms and intravenous pyelograms. X-ray examination of the spine revealed no evidence of spina bifida. An electrocardiogram revealed no evidence of congenital cardiac abnormalities. A gastrointestinal series was normal in appearance. Further extensive physical examination revealed no evidence of any other congenital anomaly.

The patient received streptomycin orally in

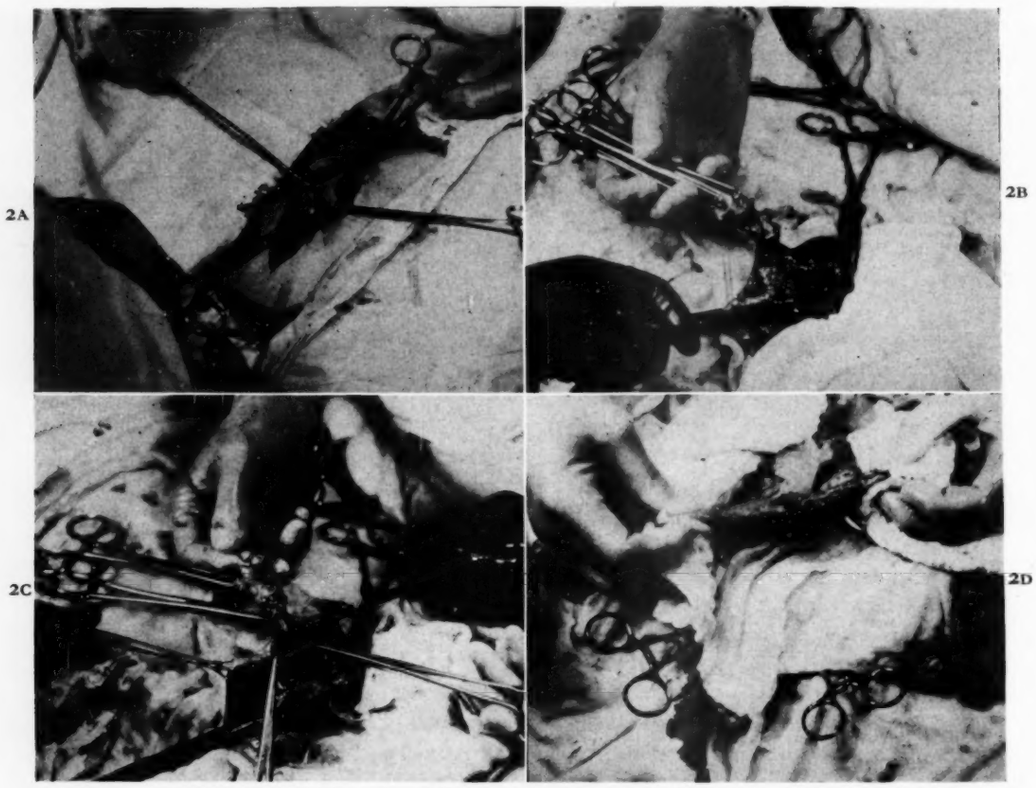

FIG. 2. Demonstration of excision of umbilicus and patent omphalomesenteric duct; A, the elliptical skin incision; B, umbilicus and duct freed from surrounding tissues demonstrating direct communication of duct with ileum; C, opening in ileum with probe passing through umbilicus and lumen of the omphalomesenteric duct and D, demonstration of closure of defect in the ileum.

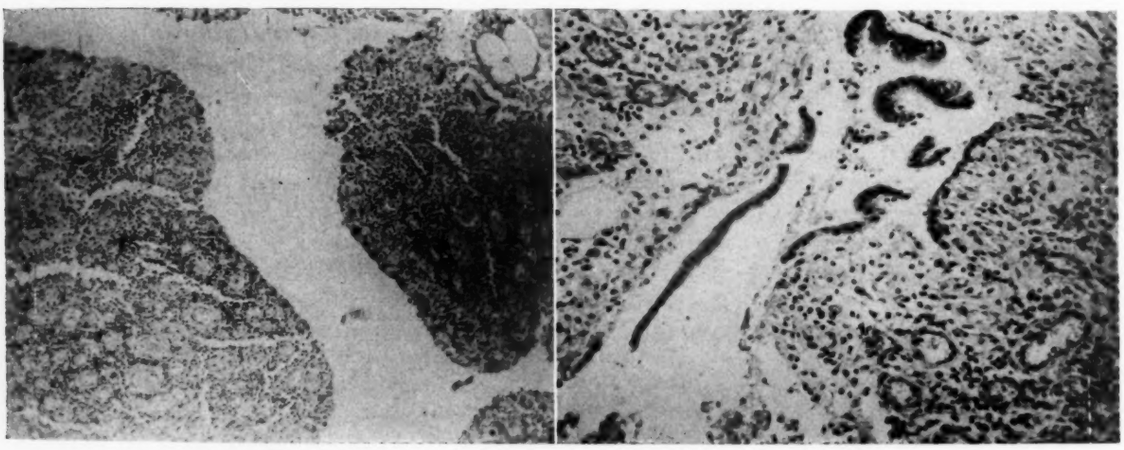

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FIG. 3. Photomicrograph illustrating the granulation tissue lining the greater portion of tract.
FIG. 4. Photomicrograph illustrating the epithelial portion of the lining.

a dosage of 0.5 Gm. every six hours for forty-eight hours prior to operation. A Miller-Abbott tube was passed on the night before the operation. Under spinal anesthesia an elliptical incision was made around the umbilicus and the transverse axis being 1½ inches lateral to the umbilicus. The incision was carried down to the fascia and the umbilical area was separated on either side from the fascia. The posterior sheath and peritoneum were opened and the duct and umbilicus were freed from surrounding structures. A short duct measuring 3 cm. in

length was found leading into the ileum at a point 36 inches proximal to the cecum. (Fig. 2A, B, C and D.) An opening in the ileum surrounding the entrance of the duct was made in the longitudinal axis of the ileum and the umbilicus and duct were excised. The defect in the ileum was closed in the transverse axis. The inflated end of the Miller-Abbott tube was passed beyond the operative site and deflated. The patient received a transfusion of 500 ml. of whole blood during the operation.

The patient had an uneventful convalescence. The wound healed by first intention after evacuation of a small sterile hematoma and he was discharged from the hospital in good condition three weeks after operation.

The pathologic report was as follows: Grossly, the specimen consisted of an elliptical segment of skin 3.5 by 1.5 by 4 cm. in the center of which a probe could be passed into the deeper tissues for a distance of 3 cm. The tract was lined by orange-yellow, granular tissue which was mottled with red. At the proximal end of the tract there was a small region of gray intestinal mucosal tissue.

Microscopically, the tract was lined by granulation tissue in which were seen large numbers of lipid-filled phagocytes and a considerable number of foreign body giant cells as well as chronic inflammatory cells. (Fig. 3.) Near the intestinal end of the tract of a small region was lined by a simple columnar epithelium which was slightly separated from the wall. (Fig. 4.) Scattered through the wall were a few mucosal glands which contained acidophilic cells of Paneth. A section through the intestinal end of the specimen revealed the mucosa to be formed by delicate villi lined by columnar epithelium containing numerous goblet cells. At the base of the villi in the crypts of Lieberkuhn were seen many acidophilic cells of Paneth. Immediately beneath the mucosa were lymphoid follicles with germinal centers and many lymphocytes less definitely arranged. The muscularis was infiltrated with moderate numbers of eosinophiles.

Near the intestinal end of the specimen the tract was partially lined by columnar epithelium. The remainder of the tract was lined by granulation tissue. In the wall were large numbers of lipid-filled macrophages possibly resulting from lipiodal injection of the tract ten days previous to surgery. No heterotopic tissue was present.

The diagnosis was patent omphalomesenteric duct.

SUMMARY

A case of patent omphalomesenteric duct is presented. Infection of the umbilicus with an associated myositis of the para-umbilical area were the presenting symptoms. No symptoms were present previously which should have led one to suspect the existence of a patent omphalomesenteric duct in this individual. By keeping the possibility in mind one can easily determine the presence of a patent duct by the introduction of iodized oil through the umbilicus by means of a catheter and by fluoroscopic observation.

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STRANGULATION OF OMENTUM IN A CONGENITAL OMENTAL DEFECT*

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PRIMARY omental torsions and strangulations of omentum in hernial sacs have received considerable recognition. While their mechanisms, symptoms and differential diagnosis have been well outlined,[1–9] diagnosis has rarely been made preoperatively.

Morris[10] describes two varieties of structures which may undergo torsion, namely, the unipolar in which the structure is fixed at one extremity while its distal end swings freely in response to any forces acting on it and the bipolar in which the structure is fixed at two points with the intervening portion left to twist axially.

The following case deals with a bipolar omentum with the strangulation of a portion in a congenital omental defect.

CASE REPORT

J. E. U., a twenty-seven year old white patrolman, was admitted to the Wayne County General Hospital and Infirmary complaining of general abdominal cramp-like pain. Two days previously after lifting an injured person, he felt a sudden pulling sensation in the lower portion of his abdomen. Shortly thereafter he began to have cramp-like pain which persisted up to the time of hospitalization. There was neither nausea or vomiting at any time. However, on the day of hospitalization diarrhea developed. Except for surgical repair of a left congenital indirect inguinal hernia four years ago, his past history was essentially negative.

On examination his temperature was 99.6°F., pulse rate 104 per minute and respiratory rate 24 per minute. The essential positive findings were limited to the abdomen. There was tenderness in the hypogastrium with voluntary rigidity in that area. A right indirect inguinal hernia was noted with tenderness at the internal ring. Digital rectal examination was negative. On the following day the pain and tenderness in the lower portion of his abdomen became more intense and the patient had five watery non-bloody bowel movements. His temperature rose to 101.6°F., and his pulse rate to 110 per minute. The right inguinal hernia was examined and a small, tender mass was palpated at the internal ring and did move when the patient coughed.

Laboratory examination showed the white blood cell count was 14,700 per cu. mm.; differential count: polymorphonuclears 76, lymphocytes 21, mononuclears 2 and basophils 1. Urinalysis was negative; the blood Kahn and Kline tests were also negative. No occult blood was detected in the feces.

A diagnosis of a strangulated right indirect inguinal hernia was made. Under ether anesthesia the hernial sac was opened and was found to contain straw-colored fluid. The omentum was found to be attached to the upper inner margin of the internal ring. The omental attachment was freed and tied with chromic No. 00 catgut. A finger was inserted into the abdominal cavity and a large mass was encountered just to the right of the midline. The hernia was repaired with No. 30 stainless steel wire using the Halsted method. The abdomen was then entered through a low right paramedian incision. A large hemorrhagic mass was found in the right lower quadrant. This was carefully delivered with the omentum through the abdominal opening and examined. The mass measured 13 by 3 by 3 cm. and consisted of omentum which passed through an omental defect with ensuing strangulation. (Fig. 1.) This mass was excised. Examination of the remainder of the omentum revealed eleven defects all of which were sutured with chromic No. 00 catgut. The abdomen was closed with No. 30 stainless steel wire. The postoperative course was uneventful and the patient was discharged to his home on the sixth postoperative day.

The gross pathologic report was "the specimen consists of a reddish mass containing some

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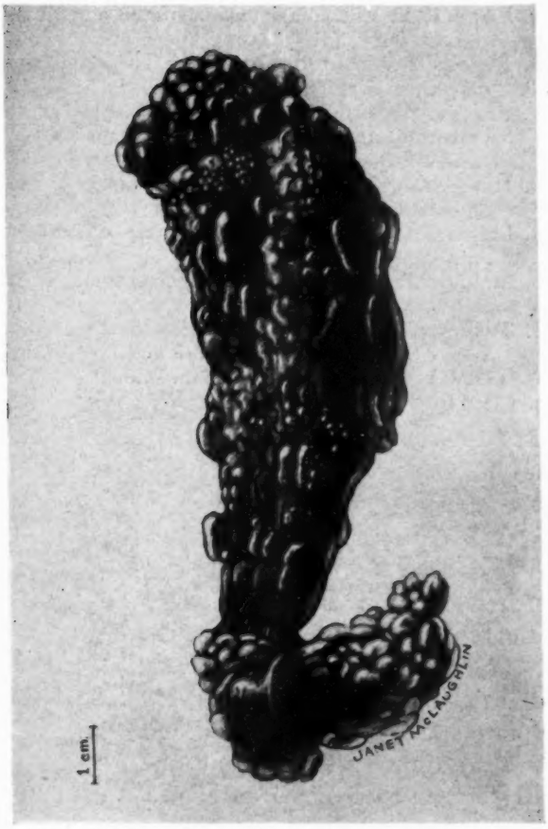

FIG. 1. Strangulated omental mass.

fat. It is somewhat tubular with tapering ends. The surface is shiny. It measures 13 × 3 × 3 cm. and weighs 80 Gm. On section the mass is hyperemic, almost hemorrhagic in appearance. It is lobulated and has the appearance of fat or glandular tissue."

The microscopic diagnosis was acute hemorrhagic omentitis with beginning necrosis due to strangulation of volvulus.

COMMENT

The mechanism by which this unusual hernia developed is illustrated. (Fig. 2.) The right lower portion of the omentum (A) was fixed to the right internal ring. The left lower portion of the omentum (B) passed posteriorly through one of the slits in the omentum, then twisted upon itself and became strangulated. At the site of the defects (C) all layers of the omentum were fused and the edge thickened. The lengths of the individual slits varied from 1 cm. to 2.5 cm. and each gave the appearance of a buttonhole.

Omental defects have been seen occasionally following abdominal operations and have caused obstruction of the small bowel. Treves[11] in his treatise on intestinal obstruction cited a case of small bowel obstruction through an omental slit. He

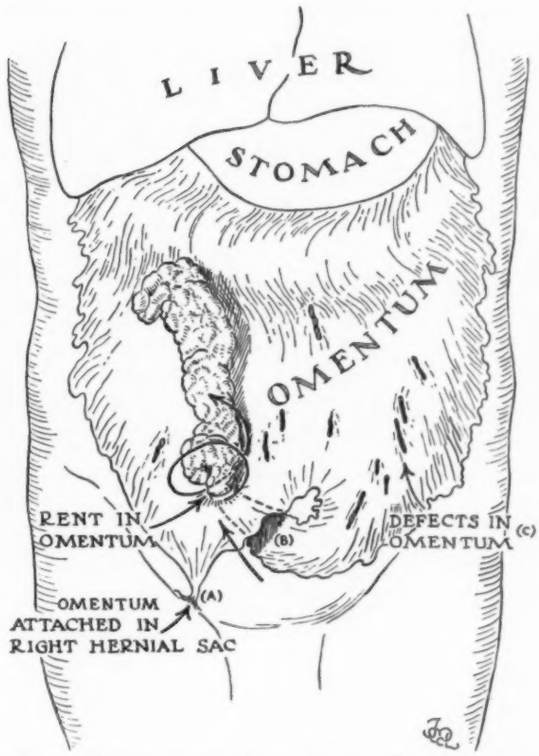

FIG. 2. Schematic drawing of strangulated omental hernia.

stated that while these defects can often be traced to an abdominal injury, they may be congenital. M. Le Fort[12] reported a case in which symptoms of intestinal obstruction developed in a young man some little time after being kicked in the abdomen by a horse. The autopsy showed two hernias with portions of small intestine through two defects in the great omentum. Our patient had no laporatomy or history of previous abdominal injury and it is believed that his omental defects were congenital.

SUMMARY

This report concerns an instance of multiple omental slit-like defects through

one of which a portion of omentum passed and became strangulated. The patient was successfully operated upon.

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As a result of experimental studies, Altemeier et al. came to the conclusion that penicillin can be a very valuable adjunct to surgery in the successful treatment of gas gangrene. The authors recommend early administration of huge doses of penicillin—as high as 1,000,000 units every three hours. The patient's recuperative powers are greatly enhanced and often the necessary amputation can be done at a lower site. All in all, the clinical picture and prognosis are greatly improved by this antibiotic. (*Richard A. Leonardo, M.D.*)

CYST OF THE URACHUS

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DEFORMITIES and diseases of the urachus while they are not rare are uncommon. During the past decade a number of articles have been published dealing with diseases of the urachus. An exhaustive research of the literature was made by Herbst[1] in 1936 and a total of 148 cases was tabulated from 1550 to 1936. Several classifications of diseases of the urachus have been made by Dudgeon,[2,3] Trimingham,[4] Wilmoth,[5] Brodie,[6] etc. There have been reports of calculus formation in a patent urachus.[7] Cysts of the urachus which have become infected have been encountered by Kantor[8] and Yoerg.[9] There has been one case of a cyst of the urachus which communicated with the sigmoid colon by a fistulous tract.[10] Patent urachus has been reported by Garvin,[11] Powers,[12] Atcheson[13] and Nichols.[14] Tumors in the urachus were reported by Dreyfuss.[15]

In the embryo the allantois extends from the cloaca to the placenta in the umbilical cord. (Figs. 1 and 2.) From that portion of the cloaca which forms the bladder extending to the umbilicus the structure is called the urachus. Ordinarily the urachus becomes cord-like and mostly obliterated between the bladder and the umbilicus. However, it is suspected that the tube remains lined with epithelium in nearly all cases even though it does not communicate with the bladder. Dreyfuss[15] states that the urachus is always minutely patent and that only when it deviates from normal or becomes infected or diseased in some way do symptoms occur which require treatment. Aside from tumors and calculi in the urachus the developmental deformities which arise are the following, namely, cysts between the umbilicus and the bladder (Fig. 3), patent urachal sinus draining at the umbilicus blind at the bladder (Fig. 4), patent urachal sinus extending from the bladder, ending blindly at the umbilicus (Fig. 5) and patent urachus extending from the bladder to the umbilicus draining urine. (Fig. 6.)

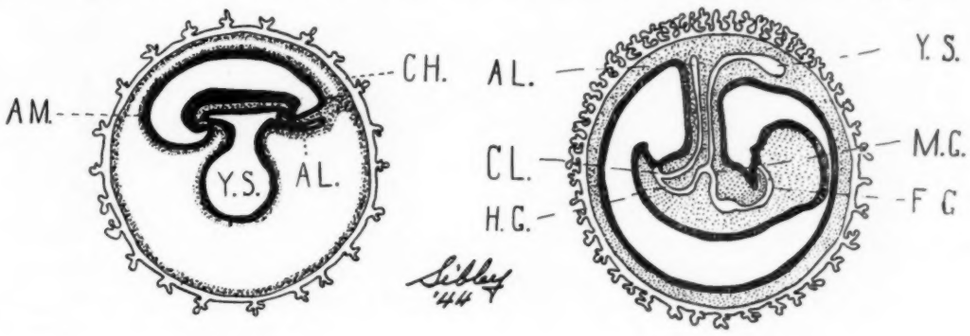

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FIG. 1 A and B, diagrams illustrating the formation of the allantois; the proximal portion of the allantois which extends from the cloaca to the umbilicus above the bladder is called the urachus. AL. indicates allantois; AM., amnion; CH., chorion; CL., cloaca; FG., foregut; HG., hindgut; MG., midgut and YS., yolk sac. (From Sibley, W. L. Meckel's diverticulum, dyspepsia Meckeli from heterotopic gastric mucosa, *Arch. Surg.*, 49: 156–166, 1944.)

The following case is reported as an example of one method of dealing with an infected urachal sinus which was of a rather narrow lumen.

CASE REPORT

E. G. L. (hospital case No. 14,800), age thirteen, white male, was admitted to the

hospital on October 27, 1946, with a diagnosis of infected navel. The history was brief. It was stated that the patient had been in good health and was unaware of any physical disorder until October 20, 1946, seven days prior to admission. At that time he was working in a

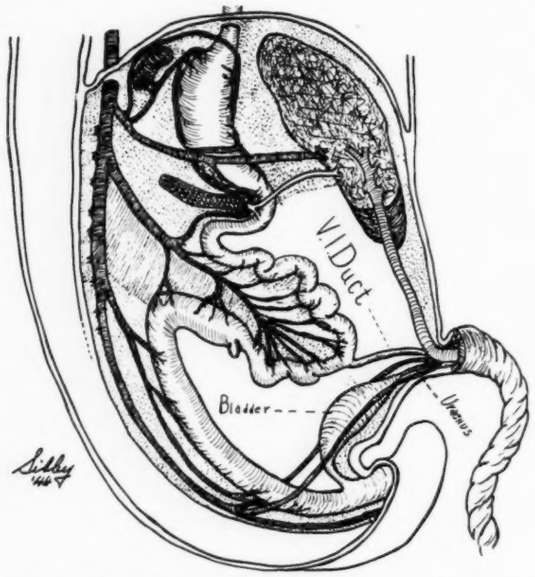

FIG. 2. Diagram showing the urachus extending from the bladder to the umbilicus; at this stage the bladder is directly connected with the hindgut at the cloaca; on each side of the bladder the hypogastric arteries are visible. (From Sibley, W. L. Meckel's diverticulum, dyspepsia Meckeli from heterotopic gastric mucosa, *Arch. Surg.*, 49: 156–166, 1944.)

creamery and dairy company and was carrying wooden cases containing bottles of milk and cream from one location to another in the plant. In carrying the cases he rested them against his abdomen to make the carrying strain easier on his light frame. He stated that his abdomen was bruised by this procedure and that soon his navel became red and sore. Within a short time the navel began to discharge a thin purulent matter. When the discharge failed to clear up and the redness and swelling at the umbilicus became more severe, he went to his family physician. The latter sent him to the hospital since it appeared to be a rather deep infection that would require hospital care.

His past history was negative and no familial diseases existed on either side of the family.

Physical examination revealed a well nourished and well developed boy at puberty. There was a slight weakness in the internal rectus muscle of the left eye with divergent squint of moderate degree which was present at times but compensated at others. There was an area of congenital alopecia in the left anterior scalp just above the forehead which measured 3 by 2 cm. The rest of the physical examination was negative except for a sinus arrhythmia and the presence of an infection at the umbilicus. A

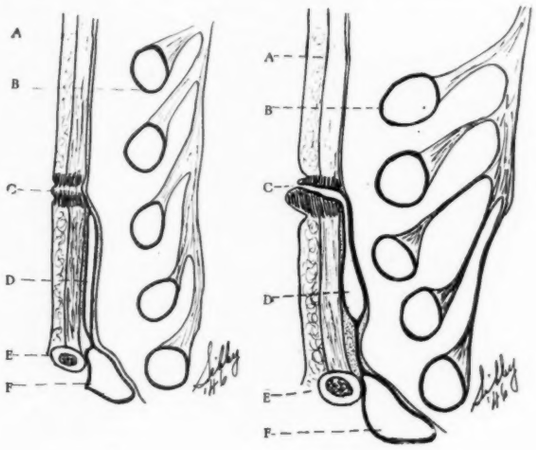

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FIG. 3. Diagram illustrating a cyst in the urachus with cord-like connections at the bladder and the umbilicus; A, indicates abdominal wall; B, intestine; C, umbilicus; D, cyst in urachus; E, symphysis pubis and F, urinary bladder.

FIG. 4. Diagram illustrating a urachal sinus opening at the umbilicus, ending blind at the bladder; A, indicates abdominal wall; B, intestine; C, umbilicus; D, cyst in urachus and E, symphysis pubis.

sinus extended downward from the umbilicus and a thin purulent discharge issued from it. The umbilicus was red and swollen and the tissue below it was quite tender and indurated for half the distance to the symphysis pubis. His body temperature was 101°F. orally; his pulse was 90.

Laboratory examination revealed a red blood cell count of 3,870,000, with 13½ gm. of hemoglobin per 100 cc. The white blood cell count was 5,000, with 62 per cent polymorphonuclear cells, 37 per cent lymphocytes and 1 per cent eosinophile. Urinalysis was negative.

The exact nature of the lesion was not known but it was suspected that it was either a urachal cyst or a cyst in the remnant of the vitellointestinal duct which had become irritated and inflamed by the trauma of carrying the milk cases on his abdomen and that the cyst had opened at the umbilicus. This had created a draining sinus which then became secondarily infected.

It was decided that conservative measures should be instigated to reduce the infection so

that when surgery was performed the chance of peritonitis would be reduced should the peritoneal cavity inadvertently be entered. Consequently, hot compresses were applied to the area of infection and penicillin solution was administered intramuscularly, 20,000 units every three hours. There was some improvement in the inflammation and the discharge from the sinus became serous in nature but the quantity of the discharge did not slacken.

On October 29th the third day after admission, his temperature was 98.8°F. and his pulse was 82. Operation was performed under cyclopropane and oxygen anesthesia, with phenobarbital, ½ gr. and atropine sulfate $\frac{1}{300}$ gr. being administered one hour preoperatively. A grooved director was inserted in the sinus opening and passed downward into a blind sac ending half the distance to the symphysis pubis. The tissue in the midline anterior to the grooved director was gingerly incised from above downward and a membranous sac was exposed lying beneath the linea alba in the midline anterior to the peritoneum. The sac was 1.5 cm. wide. It was decided to treat this condition by marsupialization much like L. A. Buie of the Mayo Clinic has treated some of his pilonidal cyst cases. The chance of postoperative hernia was ignored because of the great possibility of peritonitis if the peritoneal cavity were opened in

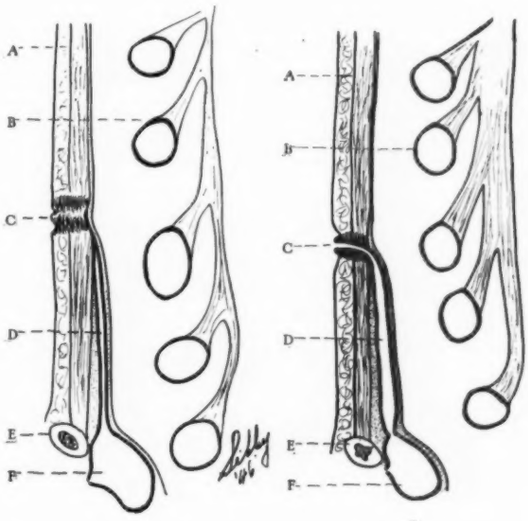

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FIG. 5. Diagram illustrating a urachal sinus opening in the bladder and ending blind at the umbilicus, A, indicates abdominal wall; B, intestine; C, umbilicus; D, cyst in urachus and E, symphysis pubis.

FIG. 6. Diagram illustrating a patent urachus extending from the bladder to the umbilicus, draining urine. A, indicates abdominal wall; B, intestine; C, umbilicus; D, cyst in urachus and E, symphysis pubis.

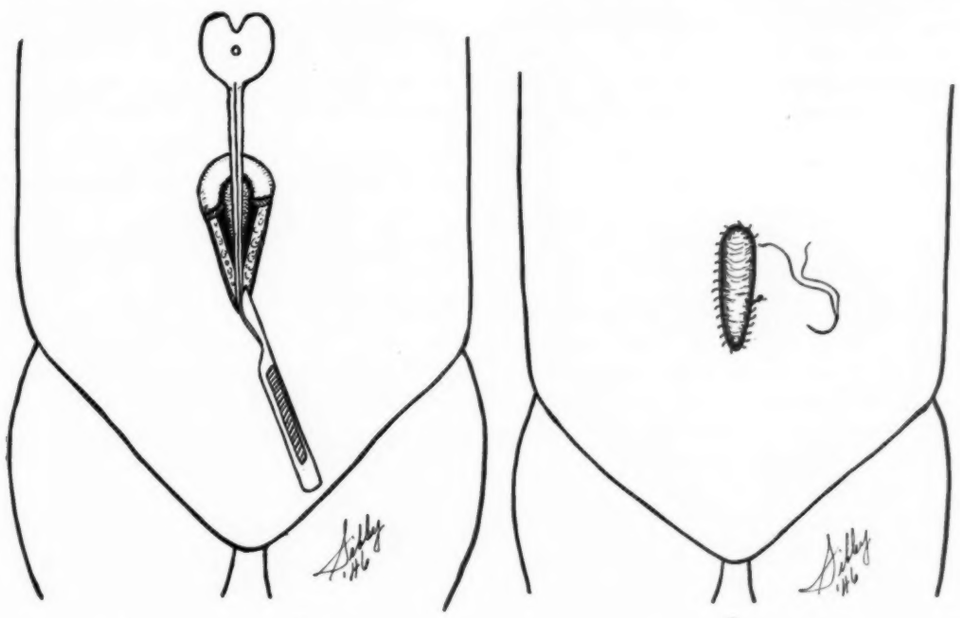

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FIG. 7. Diagram showing the method of opening the sinus in the case reported; the grooved director has been passed into the sinus cavity and the intervening tissue is being incised down to the grooved director.

FIG. 8. Diagram illustrating application of the principle of marsupialization to the urachal cyst; the skin margins are being sutured to the posterolateral margins of the cyst walls.

dissecting the sac. The marsupialization principle was carried out after removing the cutaneous covering of the umbilicus. (Figs. 7 and 8.) The result was a narrow gutter about 13 mm. wide and about 15 mm. deep. It extended from just above the umbilicus to half the distance to the symphysis pubis. There was absolutely no tendency for the rectus muscles to pull apart and there was no bulging of the base of the gutter on straining by the patient. The sutures used were No. 00 chromic catgut sewed in continuous sequence all around.

Following surgery penicillin was administered intramuscularly, 25,000 units every three hours. Regular diet was allowed the next day and early ambulation was commenced on the first postoperative day. During convalescence the wound showed no evidence of infection. It drained a serous fluid in the amount of approximately ½ ounce daily for several days but by the seventh postoperative day when the sutures came away, there was very little exudate. Penicillin was discontinued on the third postoperative day after a total of 485,000 units had been administered. He was discharged from the hospital on November 9, 1946, eleven days after surgery. At the time of discharge the wound was beginning to become epithelized and was narrowing from all sides.

He was followed and dressed by his local physician. The wound has healed rapidly and it has been completely covered by good, healthy skin. The scar has narrowed and there is no hernia present.

CONCLUSIONS

1. The condition of urachal cyst was discussed.

2. A case of an infected urachal cyst was presented.

3. The principle of marsupialization is an effective means of treating certain types of infected urachal cysts.

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LIPOMA OF THE STOMACH

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THE incidence of lipoma of the stomach is extremely rare. According to Rumold[1] who reviewed the literature from 1835 to 1940, he was able to collect thirty-three cases. He states that "Less than one per cent of all tumors of the stomach are benign and only three per cent of these benign tumors are lipomas." Since then but one case has been reported.

Symptomatology and Diagnosis. These patients most frequently present themselves to the doctor because of gastric hemorrhage as evidenced by hematemesis or tarry stools. History will ordinarily disclose complaints of vague epigastric distress, anorexia and weakness. Weight loss, epigastric pain, nausea and vomiting may or may not be present. Of all cases reviewed, a palpable tumor was present in but one case. Because of the frequent occurrence near the prepyloric region, symptoms of obstruction or retention may be present. There is nothing pathognomonic but careful roentgenologic study offers the most satisfactory differentiation from malignancy with which it is most often confused.

In an article by Cattell[2] he states, "Massive gastric hemorrhage is usually caused by penetrating duodenal ulcer and is seen less commonly in patients with gastric carcinoma. Serious hemorrhage however, is found commonly with the less frequent benign leiomyoma or the malignant leiomyosarcoma. As pointed out by Lahey, serious hemorrhage is encountered rarely with other benign tumors of the stomach, except those of smooth muscle origin."

Rarely a lipoma of the prepyloris may be pedunculated and produce symptoms of intermittent pyloric obstruction by prolapsing through the sphincter. Unless such a tumor causes erosion or ulceration of the overlying mucosa with bleeding and symptoms of peptic ulcer or because of its situation and size causes obstructive symptoms, it will probably cause no symptomatology as witnessed by the fact that 50 per cent of the cases were diagnosed at autopsy as incidental findings.

Pathology. A lipoma is defined by Karsner[3] as a tumor composed of fat tissue. It is usually derived from preexisting fat tissue but in certain instances it seems probable the connective tissue may undergo metaplasia to form fat. It varies in size from that of a pea and may have only one lobule or it may be large, multilobular and pedunculated. Microscopically, the cell is the characteristic large, signet-ring cell of adult fat tissue. It occurs subcutaneously in synovial membranes or intramuscularly or again may invade a number of organs. It rarely becomes malignant.

In an article by Hogue[4] he states, "Lipomas are thought to have the same origin as normal fat tissue. Even those arising in places where adipose tissue does not usually exist, are according to Wells believed to arise from embryonic misplacement of true adipose or pre-adipose tissue."

Lipomas of the stomach occur in the submucous or subserous portion of the wall and so may project either outward beneath the serosa or into the lumen of the stomach.

Treatment. Treatment is resection including a portion of the stomach wall because of the possibility of malignant change. Final diagnosis is after all microscopic.

Moore[5] suggested several points of differentiation of benign and malignant tumors of the stomach which although not characteristic are at least suggestive. There are

but few of the points suggested which could be accepted wholly in the case presented herein.

The differential points of benign and malignant tumors pointed out by Moore are as follows: (1) benign tumors produce a filling defect that is circumscribed and punched-out in appearance; (2) the defect is usually on the gastric walls leaving the curvatures regular and pliant; (3) while the rugae are obliterated in the immediate area of the tumor just as in inflammatory and malignant lesions, the rugae surrounding a benign tumor are more nearly normal in their arrangement and distribution; (4) they cause little or no disturbance in peristalsis and retention is uncommon except when the lesion is at or very near the pylorus; (5) they do not reveal a niche nor is there any incisura or other evidence of spasm and (6) they are rarely sufficiently large enough to be palpated. Probably the essential feature in the examination is the close and complete approximation of the walls of the barium-filled stomach. Differentiation of tumors of the stomach can seldom be absolute by x-ray.

CASE REPORT

C. B., a white male age fifty-nine was admitted to the medical service on June 25, 1946, in extremis. He presented the classic picture of shock due to hemorrhage. There was a history of progressive weakness and anorexia for the past week terminating in collapse on the night prior to admission. Over this same period of time the patient had noted tarry stools.

He had always enjoyed fair health except for inability to retain his breakfast. Nausea and vomiting were usually brought on by a severe coughing spell, probably due to postnasal drip.

One sister died of carcinoma of the breast at the age of fifty. One brother age fifty-eight had pernicious anemia.

Except for the usual findings of shock there was nothing of note on physical examination except mild mid-epigastric tenderness and external hemorrhoids. The patient was well nourished and developed. The patient's blood pressure was 90 systolic and 20 diastolic; his temperature was 101.2°F., pulse 120 and respirations 22. Laboratory data were as follows: urinalysis was essentially negative; red blood cells, 1,150,000; hemoglobin, 20 per cent; white blood cells, 12,700; polymorphonuclears, 84 per cent and lymphocytes, 16 per cent. The blood Wassermann test was negative.

During the subsequent forty-eight hours he was given 1,000 cc. of whole blood and 3,000 cc. of 5 per cent glucose in saline. He was placed on the Sippy regimen on the second day during which he vomited small amounts of milk flecked with small particles of dried blood. Following the second transfusion the red blood cells rose to 3,010,000 and hemoglobin 8 Gm. The non-protein nitrogen was 25 and blood sugar determination was 96.8 mg.

On July 7, 1946, a pale, weakened male presented for x-ray examination of the gastrointestinal tract. Barium was administered orally and was seen to pass readily to the stomach. Rugae study of the stomach was normal in the proximal two-thirds. In the pyloric third the rugae patterns were absent. There was a large, palpable, tender tumor mass occupying the pyloric third of the stomach. In this portion of the stomach the wall was fixed. Detail of the greater and lesser curvatures of the stomach were absent. The mass was immovable. (Fig. 1.)

The six-hour film showed 30 per cent gastric retention of barium. The defect was prominent. Detail of the curvatures of the stomach were absent. The head of the motile meal was seen in the splenic flexure. Several loops of ileum showed normal filling. (Fig. 2.)

The twenty-four-hour film showed normal progress of the meal but no gastric retention of barium.

In view of the patient's history, the recent profuse gastric hemorrhage, the tenderness at the site of the lesion and the defect seen, a diagnosis of gastric malignancy was made.

The patient was told of his condition and operation was advised. He was discharged from the hospital on July 9, 1946, and was readmitted to the surgical service on July 15, 1946.

Upon re-examination he presented marked pallor and a mildly tender mass about the size of a golf ball in the epigastrium just to the right of the midline. Laboratory data were as follows: red blood cells, 2,650,000; hemoglobin, 8.5 Gm.; urinalysis was negative; blood pressure was 110 systolic and 70 diastolic.

On July 18, 1946, under pontocaine and glu-

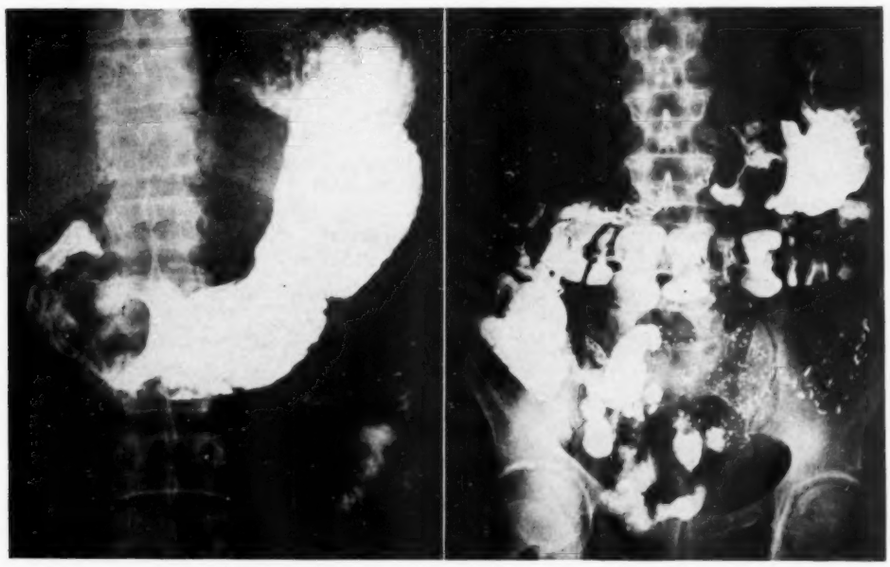

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FIG. 1 Stomach shows defect at pyloric third.
FIG. 2. Six-hour film showing retention and defect.

cose spinal anesthesia supplemented by sodium pentothal given by intravenous drip, the abdomen was opened through a high right paramesial incision. A mass about 5 cm. in diameter of moderately hard consistency was found in the anterior wall of the stomach about 3 cm. proximal to the pyloric sphincter. The overlying serosa was hyperemic. The mass was discrete and there was no demonstrable fixation nor palpable glands. Further exploratory examination was negative.

The distal third of the stomach with the proximal portion of the duodenum was resected, followed by posterior gastrojejunostomy by the loop-to-end method. Whole blood, 500 cc., was given during the operation.

Convalescence was uneventful until the ninth day. While out of bed on that day the patient coughed and opened the central portion of the incision. This was closed on the following day. The patient was discharged on August 8, 1946.

The pathologic report was as follows: The specimen was the pyloric end of stomach. (Fig. 3.) Macroscopically, the specimen consisted of a distal portion of stomach measuring 11 cm. along the greater and 6 cm. along the lesser curvature. Lying in the wall near the distal resected margin was a mass 4 cm. in diameter which was soft and yellowish. This mass partially obstructed the lumen. It pressed upon and raised the mucosa which was ulcerated over it in one place. Microscopically, sections showed that the large nodule was located between the mucosa and the muscularis mucosa. It was quite well circumscribed but exhibited pressure atrophy and scarring of the surrounding tissue. This had resulted in ulceration of the mucosa over part of the mass with fibrin and granulation tissue forming the base of the ulcer. The mass consisted of adipose tissue showing myxomatous degeneration and scarring. The mucosa of the ulcer margins was hyperplastic but showed no evidence of malignancy. The diagnosis was lipoma of stomach with ulceration of overlying mucosa.

FIG. 3. Stomach section showing lesion in prepyloric region.

SUMMARY AND CONCLUSION

1. A case of lipoma of the stomach with massive hemorrhage has been presented. It poses an interesting case for differential diagnosis.

2. Massive hemorrhage is probably more frequent in benign than in malignant lesions of the stomach.

3. Roentgenologic studies although helpful in diagnosis are by no means conclusive.

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Lipscomb and Henderson reviewed the results of arthrotomy in over 650 patients with internal derangement of the knee. The characteristic triad of locking of the knee, pain and effusion in the joint, were present in three-fourths of all cases. The authors noticed no difference in results if simply the torn piece of cartilage was removed or if the whole cartilage was excised. When the ligaments or articular surfaces are also injured, the surgical results are less satisfactory. (*Richard A. Leonardo, M.D.*)

ANNULAR PANCREAS

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THE developmental anomaly known as annular pancreas occasionally assumes practical clinical importance in the differential diagnosis and therapy of surgical conditions in the upper abdomen. Of the over fifty reported cases, however, only about a dozen have appeared to possess sufficient identity to invite surgical management; the immediate mortality in this group has been 33 per cent. The case presented herein illustrates the difficulties of diagnosis and a favorable plan of surgical intervention.

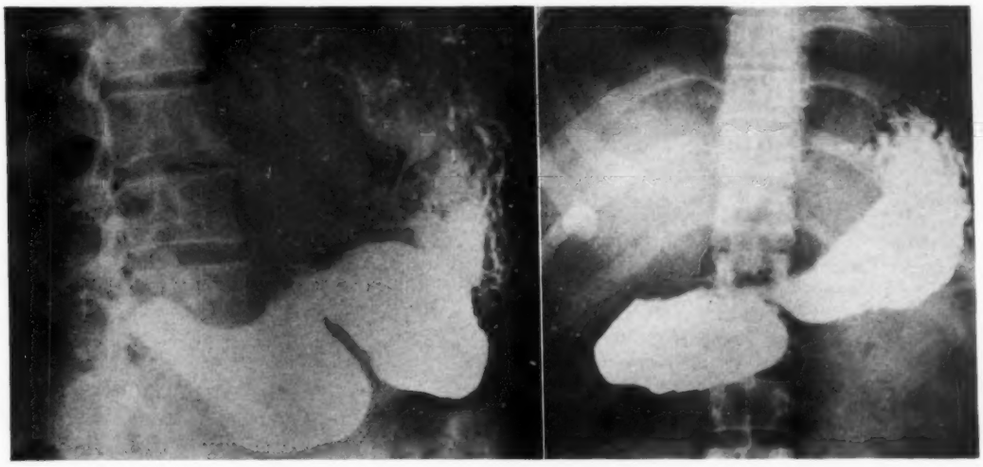

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FIG. 1. Oblique preoperative roentgenogram of barium-filled stomach; the deep constriction is actually at the juncture between the stomach and the greatly dilated first portion of the duodenum. The barium column terminates at the point of constriction by the annular pancreatic band. (Photograph by U.S. Army Signal Corps.)

FIG. 2. Anteroposterior preoperative roentgenogram of the stomach and duodenum with complete obstruction. The portion distal to the constriction is dilated duodenum. (Photograph by U.S. Army Signal Corps.)

CASE REPORT

A twenty-seven year old soldier was admitted to the Battey General Hospital on September 14, 1944, with a transfer diagnosis of gastric ulcer.

His past history was irrelevant and particularly gave no hint of any gastrointestinal disorder prior to military service. He was married, had two siblings and his family history was non-contributory.

The present illness began just a year prior to admission with gnawing postprandial and nocturnal epigastric pains. A series of hospital admissions ensued during which several x-ray studies were made of which the following report is characteristic: "There is a pronounced dilatation of the stomach with marked hourglass deformity at the mid-point and an ulcer crater 1 centimeter in diameter on the lesser curvature; only a small amount of barium passes into the duodenum at one time but the marked dilatation at the outlet most probably is due to duodenal ulcer; a 40% retention of barium is evident after six hours." (Figs. 1 and 2.)

At this hospital his response to a well devised medical regimen was indifferent and surgical exploration was advised on December 3rd.

Complete laboratory studies revealed nothing of moment and physical examination was negative except for tenderness on palpation in

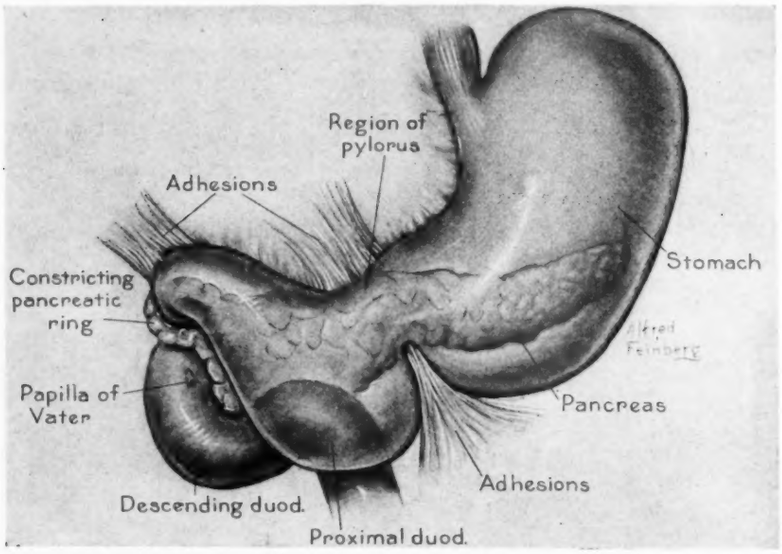

FIG. 3. Artist's diagrammatic conception of condition at operation; the dense, superficial investment of adhesions had been dissected free when the sketch was made. The location of Vater's papilla should be noted just distal to the constricting ring of pancreatic tissue. No definite sphincter could be made out at the region of the pylorus.

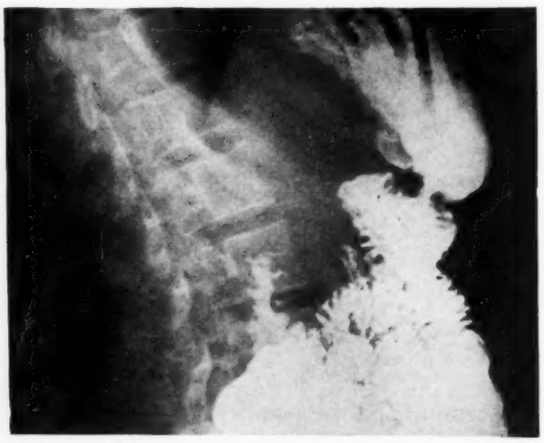

FIG. 4. Oblique postoperative roentgenogram with ingested barium; subtotal gastrectomy with Hofmeister-Polya type retrocolic gastrojejunostomy. (Photograph by U.S. Army Signal Corps.)

the epigastrium and evidence of increased gastric motor activity.

Operation was undertaken on December 12th after thorough evacuation of the stomach and with a Levine tube in place. Under spinal anesthesia of Jones' solution of nupercaine the abdomen was entered through a left paramedial incision. A dense and extensive investment by webs and bands of adhesions was found to involve the distal half of the stomach, duodenal region, gallbladder and contiguous liver border. After tedious dissection the biliary tract was visualized and found normal. The distal portion of the stomach was contracted by a firm band of scar tissue beyond which reposed an enormously dilated duodenum obscured by a dense mass of unusually vascular adhesions. Further dissection revealed a collar of pancreatic tissue completely surrounding and tightly constricting the duodenum and having continuity both superiorly and inferiorly with the head of the pancreas. When the band of adhesions at the pylorus was freed, no evidence of a sphincter could be found. (Fig. 3.)

The common duct was explored with a probe which showed the location of the ampulla of Vater to be about 1 cm. beyond the constricting ring of pancreas. In the absence of history of jaundice it seemed that there was no encroachment on the common duct.

Due to the tremendous dilatation of the duodenum, the deformity of the pylorus and evidence of previous inflammatory reaction throughout, partial resection of stomach and duodenum was thought to be the procedure of choice. Accordingly about two-thirds of the stomach and the dilated portion of duodenum were resected and gastrointestinal continuity was established with a Hofmeister-Polya retrocolic gastrojejunostomy. (Fig. 4.) The duodenal stump was closed over a clamp with a continuous Parker-Kerr suture of tanned gut; this

suture line was invested and reinforced with mattress sutures of silk. Closure of the upper portion of the gastric remnant as well as the gastrojejunal anastomosis consisted of deep layers of tanned gut and serosal mattress sutures of silk. The abdominal wall was closed with continuous chromic gut in the peritoneum and interrupted silk in both fascial layers and skin.

The pathologist reported an almost complete absence of pyloric sphincter muscle and evidence of a chronic inflammatory process in both gastric and duodenal remnants. No ulcer was demonstrated.

On January 5th a postoperative x-ray study was reported as showing a resection of the stomach with gastrojejunal anastomosis. Apparently about two-thirds of the stomach had been removed and the stoma functioned well with a minute, five-hour residue.

The postoperative course was uneventful and after an observation period of three months the patient was discharged from the service with a certificate of disability.

COMMENT

In general there are two theories concerning the mechanism of embryonic development of this anomaly. It has been suggested that it is simply a hypertrophy of pancreatic substance with eventual encirclement of the duodenum. Perhaps more tenable is the motion that it is a failure of the ventral anlage of the pancreas to fuse with the dorsal anlage.

Practically it will not become a clinical problem unless the constricting effect is sufficient to obstruct the duodenum or the common bile duct.

The thirteen patients operated upon illustrate the various consequences of such obstructions. (Table 1.) Several, including

TABLE 1

PATIENTS WITH ANNULAR PANCREAS TREATED WITH OPERATION

Case	Reported by	Age and Sex	Operation	Result	Remarks
1	Vidal 1905	Male 3 da.	Posterior gastro-enterostomy	Cured	Also had congenital atresia of duodenum
2	dos Santos 1906	Female 26 yr.	Posterior gastro-enterostomy	Died (pneumonia)	Had chronic interstitial pancreatitis
3	Lerat 1908	Female 46 yr.	Resection of pancreatic ring	Cured	Drainage ceased on 13th day
4	Smetana 1928	Male 74 yr.	Posterior gastro-enterostomy	Died	Marked fibrosis of pancreas; cancer of cystic duct
5	Howard 1930	Female 46 yr.	Division of ring	Cured	Pancreatic fistula requiring second operation
6	Brines 1930	Male 35 yr.	Drainage of pancreatitis	Died	
7	Zech 1931	Female 27 yr.	Division of ring; Heineke-Mikulicz plastic on duodenum	Cured	Small pancreatic fistula
8	Brines 1931	Male 44 yr.	Posterior gastro-enterostomy	Died (respiratory infection)	
9	Truelsen 1940	Male 35 yr.	Posterior gastro-enterostomy; plastic on duodenum	Cured	
10	Lehman 1942	Male 23 yr.	Partial resection of ring	Recovery but persistent symptoms	
11	Gross and Chisholm 1944	Female 3 da.	Duodenojejunostomy	Cured	
12	Custer and Waugh 1944	Male 74 yr.	Partial gastrectomy with gastrojejunostomy	Cured	Concomitant gastric ulcer
13	Ohlmacher and Marshall 1946	Male 27 yr.	Partial gastrectomy with gastrojejunostomy	Cured	Partial absence of pylorus

(From GROSS, R. E. and CHISHOLM, T. C. Annular pancreas producing duodenal obstruction. *Ann. Surg.*, 119: 759–769, 1944.)

our own, exhibited advanced duodenal obstruction with patent biliary tracts. Others showed the effects of biliary obstruction either in the form of jaundice or pancreatitis of varying degree or both.

There was some preponderance of males among the patients operated upon. The two youngest patients were a male and female both three days old and the two oldest were males seventy-four years of age. Up to the present a preoperative diagnosis has rarely been made in these cases and intervention has rested on the basis of obstruction or inflammatory reaction. Anatomic diagnosis should be relatively feasible in those cases becoming symptomatic in infancy except that here x-ray investigation tends to be less complete. We are inclined to believe that henceforth we should be able to combine the history, clinical findings and x-ray evidence to make an exact preoperative diagnosis which Lehman accomplished in Case 10 of the reported series.

The surgical treatment of these patients will depend, of course, on the particular type of involvement. In general the operations so far reported have consisted of measures to relieve the duodenal obstruction. There are, however, reports of annular pancreas in infants in whom jaundice was the chief complaint. So far these cases have terminated fatally but the possibility of cure may be subsequently realized by choledocho-entero-anastomosis.

For relief of the duodenal obstruction four operative plans have been employed.

1. Resection or simple division of the ring of pancreatic tissue was used in four of the reported cases. There was no mortality in these four cases, one of which was combined with a Heineke-Mikulicz duodenal plastic, but temporary pancreatic drainage and a tendency to persistence of symptoms complicated the postoperative course.

2. Posterior gastro-enterostomy was used in five cases. While theoretically this procedure should be relatively satisfactory, the results with four deaths were unfortunate.

3. Duodenojejunostomy has been used in one case with excellent results and would appear to be the procedure of choice when the condition becomes manifest in infancy.

4. Partial gastrectomy with gastrojejunostomy has been used in the last two reported cases, that of Custer and Waugh and finally our own. When the condition first becomes obvious in adults, there will be a definite tendency for development of complicating factors such as ulcer, chronic inflammation and scar-tissue formation. In the majority of these cases when the ampulla of Vater is distal to the constriction, the stomach and proximal duodenum have been largely deprived of the benign effect of reflux bile and have been unnaturally exposed to the impact of gastric acidity. It seems logical that better end results will be achieved by excision of this devitalized tissue. Abundant proof exists that in good hands partial gastrectomy is accompanied with little if any higher mortality than that of gastro-enterostomy.

SUMMARY AND CONCLUSION

A case of annular pancreas with successful surgical correction is reported and a table of the surgically treated cases is brought up to date.

There is little doubt that the anomaly of annular pancreas will become clinically important with gradually increasing frequency. At the moment we would suggest that for cases occurring in infancy duodenojejunostomy be given primary consideration, while for correction of the complicated condition in adults, partial gastroduodenal resection with gastrojejunostomy is the procedure of choice. Very rarely an additional biliary tract anastomosis may be required.

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A pancreatic fistula may persist after marsupialization of a pancreatic cyst. If it does not heal after six months of medical treatment, it should be treated surgically. Excision is often difficult and dangerous. A very satisfactory and safer method is to implant the fistulous tract into the anterior surface of the stomach unless the fistula is located in the gastrocolic ligament. In this latter instance it is more convenient to place the implantation in the posterior gastric wall. (*Richard A. Leonardo, M.D.*)

STRANGULATED INGUINAL HERNIA IN A FOUR WEEK OLD INFANT, WITH RESECTION AND RECOVERY

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ALTHOUGH inguinal hernia is generally conceded to be the most common of congenital anomalies, strangulation thereof in infancy is quite rare. Resection of a bowel so strangulated is even more rare, as the mortality in this condition has been estimated at as high a figure as 90 to 100 per cent. The authors were able to find a number of reports concerning various abdominal and pelvic viscera which were strangulated in inguinal hernias in small infants and which were successfully resected. However, the number of successful resections of gangrenous bowel was extremely small. The case described herein is such a resection, with a happy conclusion.

CASE REPORT

Baby C. was born October 19, 1946. On November 20th he was admitted to the pediatric service of one of the authors (J. E. J.) at St. Vincent's Infirmary. Four days prior to admission he had developed a cold with a cough. His mother noticed that after coughing there was a mass in his right groin. He was treated for four days by his family physician who then referred him to J. E. J. who hospitalized him and called the senior author (H. S. S.) for surgical consultation. The baby's last spontaneous stool had been passed three days prior to his admission. At that time he began projectile vomiting.

On examination we saw a very ill, white, male infant who lay listlessly in bed. Passage of a hand before his face produced no wink although the ciliary reflex was present. His abdomen was tense, distended and tympanitic. The right inguinal canal and upper scrotum were filled with a tense, tender mass which appeared purplish through the skin. Slight edema was present. Rectal temperature was 100.0. A deep, productive cough was present. The patient was not weighted due to his critical illness. Laboratory findings on admission were as follows: urinalysis negative except for scant volume and 2 plus albumin; hemoglobin was 92.3 per cent; red blood cells, 4,750,000 and white blood cells, 12,000. Schilling blood count revealed one myelocyte, two juveniles, six stabs, twenty-five polymorphonuclears, sixty-five small lymphocytes and one monocyte.

Wangensteen duodenal suction was started immediately and 60 cc. of plasma were infused subcutaneously. Three hours later atropine (1/600 gr.) was administered and an hour later the patient was taken to surgery.

Under drop ether plus 10 cc. ½ per cent novocain in the line of incision an incision above and parallel to Poupart's ligament was made and the sac exposed. It was lightly adherent to the scrotum throughout; when opened it was found to consist of the unclosed tunica vaginalis. In its distal portion and forming the posterior sac wall was a normal testicle with its appendages. In the sac was a loop of terminal ileum about 3½ inches long and quite black. The bowel surface was not yet rough but the normal luster was gone. The mesentery contained dark thrombi. At the base of the sac was a constricted internal ring which had eroded a deep groove into the gut wall. This ring was nicked and the gut drawn into the wound until healthy bowel appeared. Application of hot saline packs for a period of twenty-five minutes caused no improvement so the wound was extended sufficiently; more bowel was exposed and the gangrenous portion excised. The remaining 1-inch distal segment of ileum was carefully closed with two layers of sutures and then with purse-string suture. An end-to-side anastomosis was done between the proximal segment and the bulb of the cecum. Chromic No. 00000 was used for the intestinal sutures. The anastomosis was reinforced with four tension sutures of the same material. The hernia was then repaired and the wall of the abdomen restored and closed with cotton No. 50. The wound was dressed with a collodion patch. During the operation the patient had

some respiratory difficulties which responded satisfactorily to 3 m of metrazol.

Immediately on his return to the ward the patient was placed in shock position in a hot box where he remained for forty-eight hours. Suction was resumed and another 60 cc. of plasma were infused under the skin. Constant nasal oxygen was administered supplemented with 2 m of Metrazol every two hours for four doses. Hartman's solution, 100 cc., was given subcutaneously every six hours; once a day 50 mg. of ascorbic acid were added to one of the infusions. Every three hours 50,000 units of penicillin were given intramuscularly as prophylaxis against pneumonia and possible peritonitis. The patient's position was changed hourly.

On the first postoperative day the patient's abdomen was soft and his color good. Every four hours he was given 1 ounce of mother's milk; at the mid-point between feedings 1 ounce of 5 per cent amigen in 5 per cent glucose in saline was administered through the duodenal tube which was clamped for thirty minutes following each feeding. Phenobarbital was given as needed for restlessness. On the first night he passed a brown stool and much flatus. His recovery from then on was uneventful except for some facial edema which cleared up when the fluids were discontinued. Plasma was discontinued on the sixth day. A postoperative hydrocele developed which disappeared by the time of his discharge on the fourteenth postoperative day.

The pathologic report revealed that the specimen consisted of about 7 cm; of small intestine and hernial sac. The small intestine was dark blue, almost black in color; this color was persistent throughout the wall and also in the mucosal surface which was definitely glandular. Microscopically sections from the portion of gut showed marked congestion and a very dense accumulation of blood in the submucosa area. This portion of the gut was markedly thickened, probably twice the normal thickness. The structure of the submucosal area including the blood vessels was largely obscured by dense accumulation of blood. There was also increased accumulation of blood in the muscle walls but this was not so marked as in the submucosa due to the better resistance of the walls of the capillaries. There was some thickening of the serosa and here again marked accumulation of red blood cells was seen. There was some degeneration of the mucous membrane; the epithelial cells did not show good detail and good outline. The diagnosis was marked congestion of the intestine.

CONCLUSIONS

The authors have presented a case of strangulated, right, indirect, complete inguinal hernia into the unclosed tunica vaginalis, with gangrene of the strangulated bowel, resection thereof and recovery in a one month old infant.

New Instruments

A NEW DISSECTING HEMOSTAT*

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Chicago, Illinois

THERE are many surgical situations in which a vessel or duct must be dissected bluntly yet delicately from the surrounding tissue before a clamp is placed. The instrument to be described has been developed to simplify and add safety to such dissections. It has been used to advantage particularly in thyroidectomy and cholecystectomy. It is offered as a valuable adjunct in everyday surgical technic and not as another gadget for occasional use.

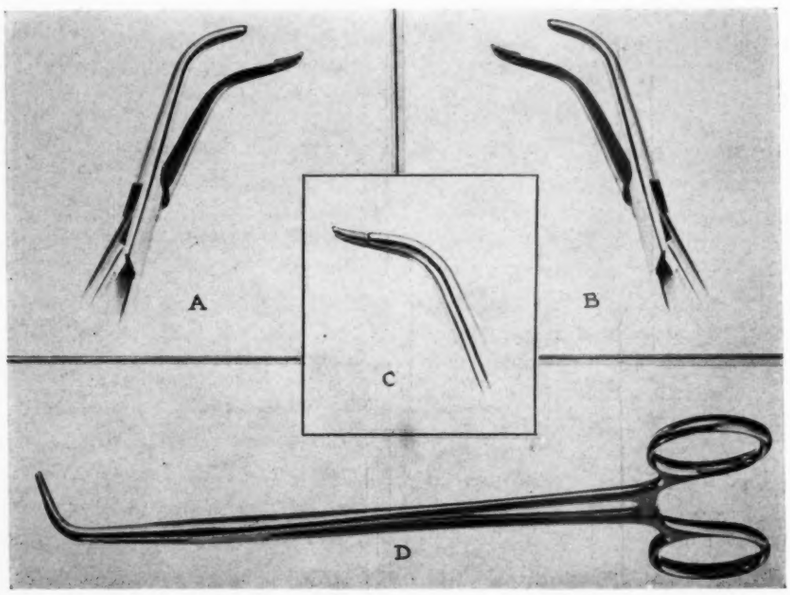


FIG. 1. A, left-handed model of dissecting hemostat with blades open showing shape of dissecting nose; B, right-handed model with similar view; C, appearance of instrument with blades closed; D, full-length view of instrument; modified from Mixter-type forceps.

The essential feature of the instrument is that it has a slightly curved prolongation attached to one of the blades of a curved hemostat. This simple modification of the average curved hemostat permits the saving of at least one extra instrument and considerable time in dissection. Most surgeons will agree that whenever feasible they prefer to ligate behind a clamp rather than do a loop ligation and cut between the ties. The aneurysm needle is a valuable instrument because it allows for the passing of suture material about a duct or vessel. However, cutting between free ties is fraught with obvious dangers. The instrument described herein has the advantage of serving as an aneurysm needle and a clamp at the same time, thus giving the surgeon the added security of ligating behind a

* From the Departments of Surgery, Northwestern University Medical School and Michael Reese Hospital, Chicago, Ill.

spread position while two other instruments are passed between the open blades to clamp the vessels. Thus one instrument is used for dissection and maintaining a free passageway behind the vessels while the other instruments are used to clamp ado about the removal of one instrument and the insertion of another. (Fig. 2.)

A further source of security to the surgeon in the use of this instrument is that the long nose on the blade makes it considerably easier to ligate the structure in-

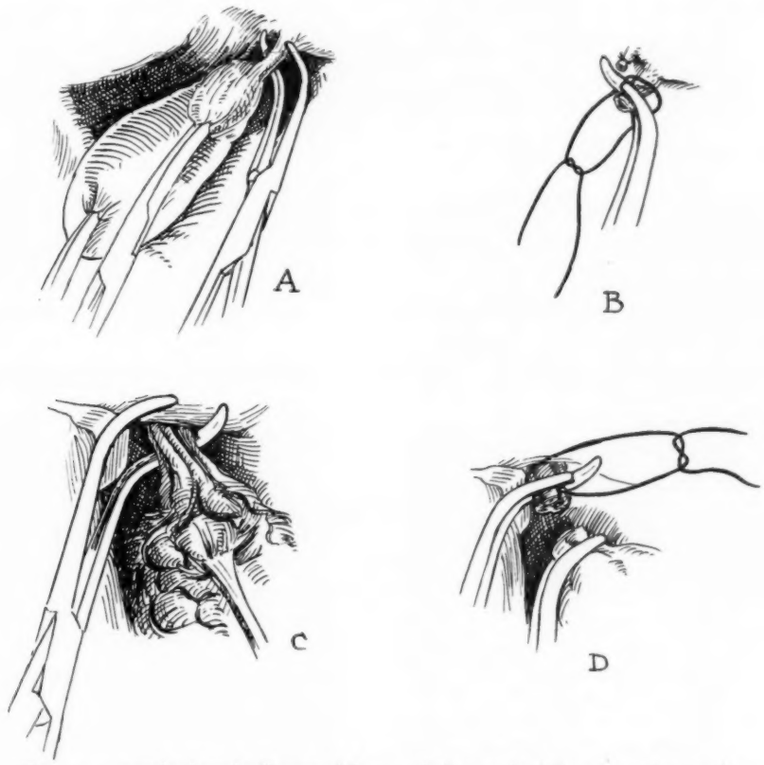


FIG. 2. A, cystic duct is dissected free and clamped with one motion; B, by hooking ligature behind dissecting nose of clamp ligation in deep places is facilitated and the ligature cannot slip off the tip of the instrument; C, dissection and clamping of superior thyroid vessels; D, shows ease of ligation behind clamp.

the vessels. With the new dissecting hemostat it is possible to dissect behind the vessel with the blunt nose dissector of the instrument while in the same motion the structure becomes clamped. In this way the technic is facilitated and is much less clumsy. A right and left clamp make it possible to attack the structure from either side. The same situation holds in the dissection and clamping of the cystic duct and cystic artery in cholecystectomy. With one motion the nose of the instrument dissects behind the structure to be clamped and the clamp is immediately closed with no more volved since the suture material cannot slip off the tip of the clamp because of the additional metal beyond the clamped structure. This makes it possible to hook the suture material behind it easily even in deep places. Dissection can be carried out with the blades either open or closed; and if the structure is large, dissection can be begun with the blades closed. When the nose of the instrument slips under the structure, the blades can be open so that the clamping is done without withdrawing and reinserting the instrument.

This design can be applied in principle

to modify any curved forceps in use today. Thus the surgeon can adapt this principle to apply to larger as well as smaller hemostats.

SUMMARY

A new dissecting hemostat is presented which greatly facilitates the dissection and clamping of certain ducts and vessels. It is particularly applicable in thyroidectomy and cholecystectomy. It has also been used in saphenous vein ligations and similar procedures. The advantages are enumerated above. The simplicity of the instrument makes for a wide field of applicability in practical, everyday surgery.

ONE-STAGE resection and anastomosis of the colon is a safe procedure, according to Hinton and Localio, even without a proximal colostomy or ileostomy providing definite intestinal obstruction is not present. A careful surgical technic and an aseptic anastomosis with the Furniss clamp is the procedure recommended together with careful preoperative preparation and postoperative treatment. (*Richard A. Leonardo, M.D.*)

ATRACTION YOKE STABILIZER

G. J. Curry, M.D.

Chief, Section for Surgery of Trauma, Hurley Hospital

Flint, Michigan

IT is certain that many fracture surgeons have had difficulty in preventing rotary movements of the distal fragments in fractures involving the tibia and fibula, particularly in the mid- and lower thirds. The continuous tendency of the foot to assume a position of inversion or eversion with the use of the ordinary traction yoke attached to a Kirschner wire placed through the os calcis is a common finding. This produces torsion at the fracture site and associated malalignment.

For the past few years the writer has used a device in the form of a stabilizing bar attached to the side arms of a traction yoke particularly adaptable to the Zimmer Traction Yoke. The ends of the stabilizing bar are bent so as to curve around the longitudinal shank of the Thomas Splint.

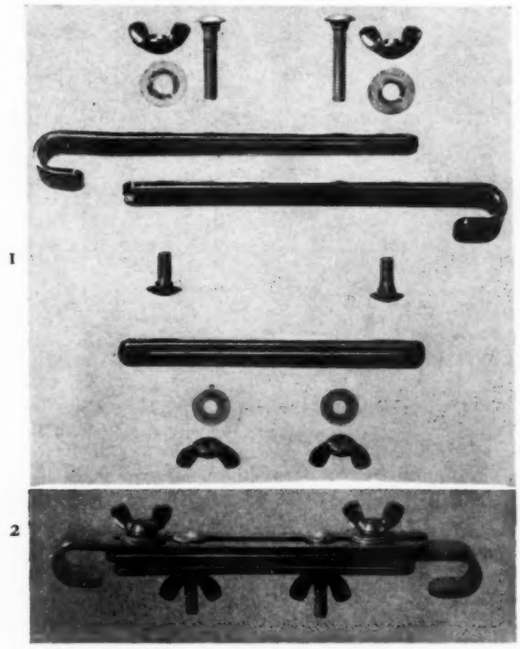


FIG. 1. Photograph of stabilizer parts: A, stabilizer slotted bars with bent ends; B, supplementary transfixion bar: C, fixation thumb screws.
FIG. 2. Photograph of stabilizer assembled.

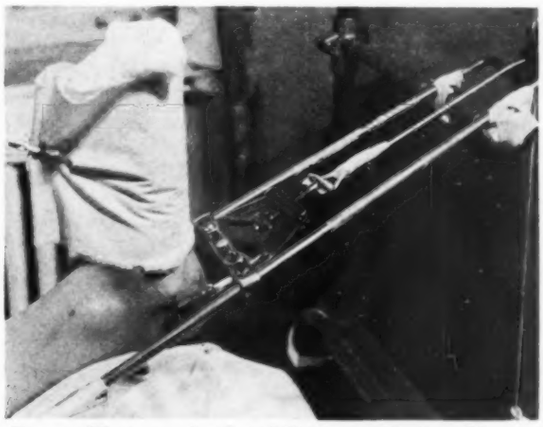


FIG. 3. Photograph of stabilizer attached to Zimmer traction yoke, the combined units being attached to a Kirschner wire through the os calcis for direct skeletal traction in multiple fractures of the tibia and fibula. Note the curved ends of the stabilizer which prevent slipping from the longitudinal rods of the Thomas splint.

Perfection in construction has developed a unit that is adjustable in two parts, slotted so as to produce any desired length. A supplementary bar is used for transfixion of the stabilizing bars to the traction yoke. (Figs. 1 and 2.)

This device has been used many times by members of the Section for the Surgery of Trauma, Hurley Hospital, with continued enthusiasm. (Fig. 3.) As mentioned it is indicated in the management of fractures involving the tibia and fibula when skeletal traction with a Thomas Splint is selected, utilizing a Kirschner wire through the os calcis.

SMALL DERMATOME FOR ACCURATE SPLIT THICKNESS SKIN GRAFTS

OTTO J. PRESTON, M.D.
Flint, Michigan

THIS instrument was designed to meet the need for a small dermatome for the surgical treatment of surface defects of the face or body and especially the hand and fingers. The principles of its operation are based upon those of the larger dermatomes, i.e., fixation of the donor site against a firm flat surface and selectively split-cutting the skin at a fixed predetermined level.

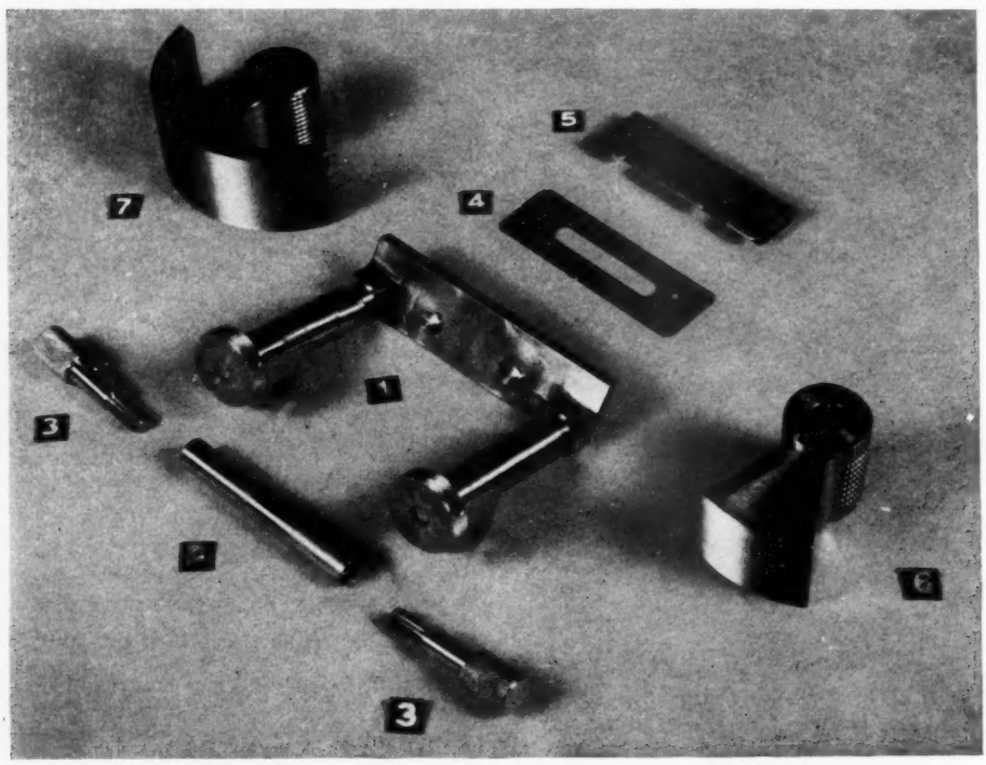
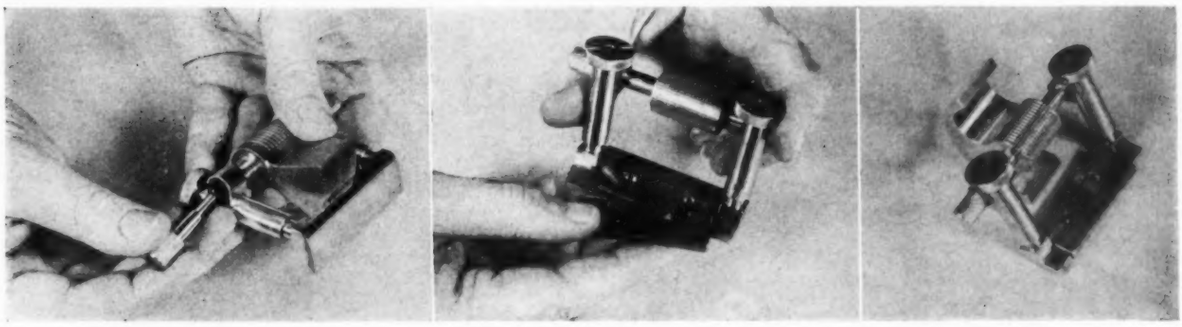


FIG. 1. 1, blade-holding fixture with micrometer adjusting screws; 2, shaft for drum; 3, screws to secure axle to fixture; 4, razor blade; 5, clip to retain blade; 6, a 1 by 1 inch drum and 7, a 1 by 3 inch drum.

The apparatus consists of a blade-holding fixture with two micrometer adjusting heads onto which is fitted a removable shaft or axle. (Fig. 1.) On the axle may be placed either of the two freely revolving, interchangeable drum segments. One drum has a flat segment measuring 1 by 1 inch, the other 1 by 3 inches. The cutting blade used is a standard Durham-Duplex razor blade which is always available and which, because of its low cost, may be discarded following use rather than sharpened. After assembly of the drum on the axle and the axle to the fixture with the two knurled screws the razor blade is slipped into place and held firmly at a 20 degree angle against the drum surface by the retaining clip. (Figs. II and III.) The blade is adjusted closely and evenly to the drum by means of the micrometer heads which are marked



II III IV

FIG. II. Assembly of small drum and axle to fixture.
FIG. III. Blade in place, attaching retaining clip.
FIG. IV. Complete large drum assembly.

clamp and yet getting around the structure with the same instrument. (Fig. I.)

For example, in dissecting the superior thyroid vessels for ligation it is often necessary to dissect them bluntly by spreading a hemostat. The hemostat is then held in a in .001 inch gradations. The fixture is then backed away from the drum by reversing the heads to the selected thickness of skin. The 2-inch width of the shaft and blade permits a 1-inch travel of the cutting fixture for the to and fro cutting stroke. The remainder of the procedure using skin adhesive, etc., is identical to that used with the larger instruments. (Fig. IV.)

Because of its size this device has been successfully used with local surface anesthesia alone (1.5 per cent procaine hydrochloride without vasoconstrictor) and has proved convenient in the treatment of small surface defects of the dorsum of the hand and fingers and for surgical defects following full thickness flap grafts over tendons and joints.

The Early Art of Surgery

VI. THE KAEHN PAPYRUS

FELIX CUNHA, M.D.
San Francisco, California

WHEREAS the Ebers Papyrus speaks of operations for aneurysm and hernia, yet nowhere technically describes the steps of such operations, and also speaks of cauterization and incision with a hot knife, the only words one can find elaborating on these procedures are, "Thou shalt make an operation." The Smith Papyrus differs in that it describes within its pages actual technics for suturing and ligation of vessels.

The Kaehn Papyrus is presumed to have been written about 1900 years B.C. It represents one of the casualties in the progress of knowledge. Unfortunately only a small fragment has survived the ravages of time. Papyrus dries and disintegrates. It crumbles on handling so that it is impossible to decipher much of even that small fragment which exists. What little can be deciphered is mainly of gynecologic interest but there is a sufficient amount of medical and surgical material to qualify it for inclusion among medical papyri.

The following about sums up what can be actually deciphered and in part inferred: pelvic and vaginal states of inflammation were treated with heat, poultices and a version of douching with a few recommendations or prescriptions for making the solutions to be used.

With its presumed date of origin being 1900 B.C. it is three hundred years older than the Smith Papyrus yet some of the language used is in places almost identical. Examples of such similarity of language are the following: "Moor him at his mooring stakes," meaning, put him on his customary diet and do not give him a prescription. "Thou knowest he has reached a decisive point," meaning, hold all opinions until you know whether he is going to live or die. "His countenance is clammy with sweat," meaning, he is in shock. "He has become pale and has shown exhaustion; he walks shuffling with his sole," shock. "Something entering from outside, not the intrusion of anything which his flesh engenders," meaning, infection. "While heat continually issues from the mouth of his wound at thy touch"; "Its two lips are ruddy"; meaning, infection or inflammation or both.

The aforementioned represents about the sum total which can be extracted from this fragment. For this reason the Kaehn Papyrus is more of bibliographic rather than of actual surgical interest.

It has, however, another facet, a semantic one; the expressions used, the manner of putting words together to mean certain things and emphasis on descriptive words and phrases made up the medical idiom or jargon of those days.

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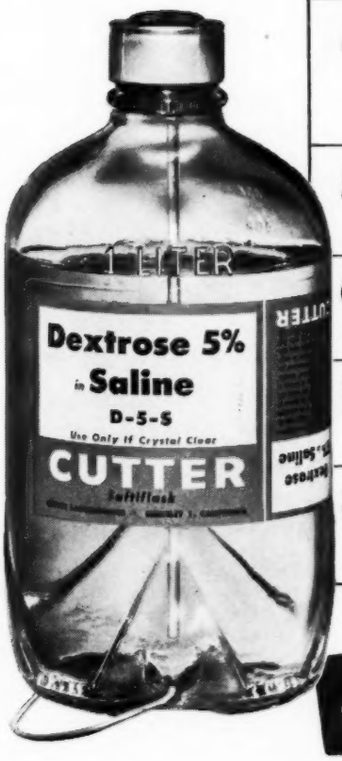

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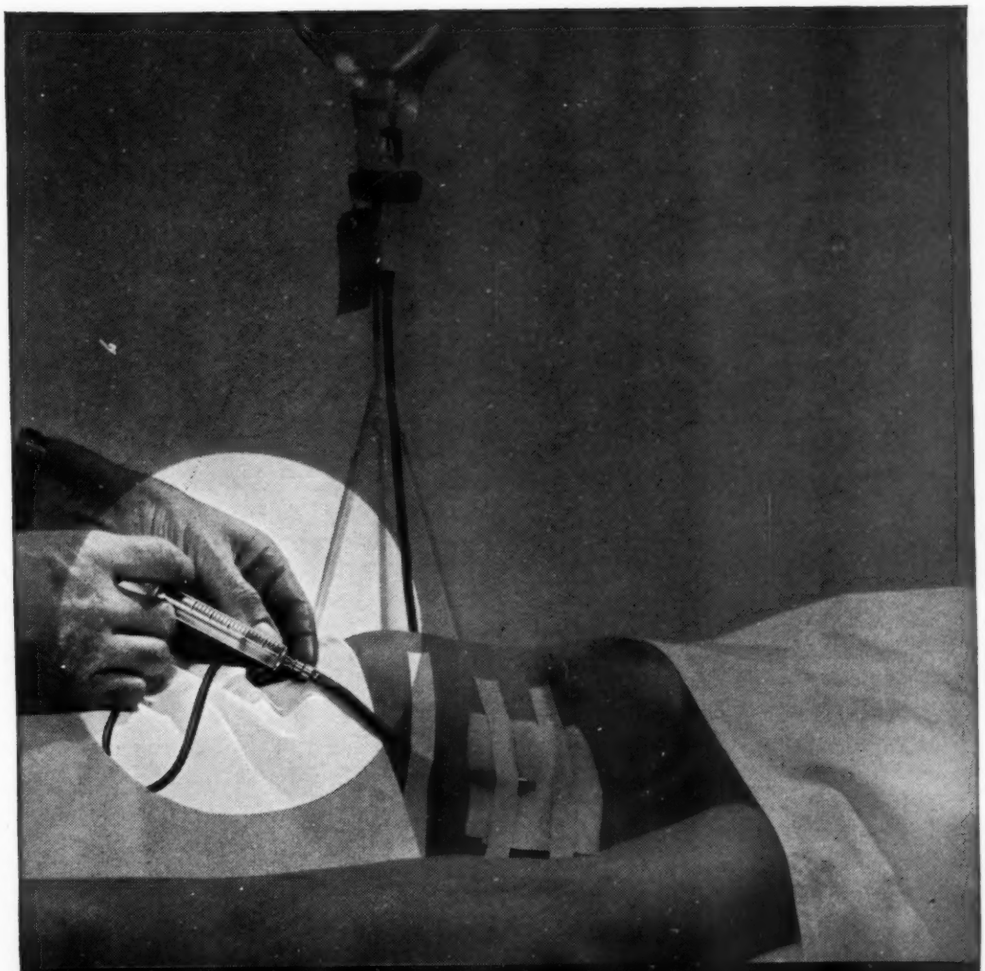

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Outside the Ivory Tower

(*continued from page 22*)

DR. Harold M. Marvin, president of the American Heart Association, asserted that medical investigators have learned that so-called "heart attacks" are not fatal or disabling except in a small percentage of cases, that high blood pressure is not the terrifying condition it was once thought to be and that thousands of men and women with heart disease are leading active lives without discomfort. "An intelligent understanding," Dr. Marvin said, "would lead thousands of lay people to participate in the work of local groups, where they are sorely needed. After all, this battle against our greatest health problem must be fought by all the people, not just by the doctors; unless thousands of citizens give their help we cannot hope for an early or decisive victory."

THE U. S. Air Force Medical Service will commission 300 civilian physicians now serving as internes as first lieutenants on active duty with the Air Force Medical Reserve Corps, Major General Malcolm C. Grow, Surgeon General of the Air Force, announced. Eligible to receive commissions are medical school graduates now serving interneships at approved hospitals and who have at least six months of interneship remaining. Physicians who are so commissioned will serve two months of active duty for each month of interneship as commissioned members of the Medical Reserve Corps. Upon completion of active duty tours officers who apply and are selected as members of the regular Air Force Medical Corps will be eligible for participation in the Air Force residency program to be conducted at civilian and military hospitals.

THE first two nurses to be granted direct commissions in the U. S. Air Force Nurse Service Reserve from civilian life since establishment of a separate Air Force Medical Service were sworn in recently before Major General Malcolm C. Grow, U. S. A. F. Surgeon General, and Captain Verena M. Zeller, Acting Chief Nurse. The nurses are D. Zay Cowden of Lincoln, Nebraska, who was commissioned a first lieutenant and Dorothy Mae Horton of Akron, Ohio, who received her commission as a second lieutenant.

DR. Wallace O. Fenn, Professor of Physiology at the University of Rochester, has been awarded the first Sharp & Dohme Award of the American Physiological Society according to a joint announcement released by the Society and the Philadelphia pharmaceutical and biological firm. A cash award of $1,500 was presented by Sharp & Dohme through the auspices of the Society in recognition of Dr. Fenn's outstanding contributions to physiology. It is awarded to that individual whom the Society believes "most nearly represents the best accomplishment and promise in American physiology today." Basis for selection is by written vote of the Society's membership which numbers more than 1,100 scientists. The award is to be used by Dr. Fenn to represent the Society at the Eighteenth International Congress of Physiology in Copenhagen, Denmark, in August, 1950, where he will present a paper on "The Composition of Alveolar Air."

THE nationwide list of medical organizations suddenly brought under investigation by the Antitrust Division of the Justice Department during the past few weeks soared to twenty-two medical societies and allied groups (October, 1949) with an announcement by the American Medical Association that two additional state societies and four more county societies have been made the targets of government investigators. The A. M. A. Board of Trustees in its announcement recently flatly charged the federal government with acting in "bad faith" and declared that "The rapid spread of this epidemic of investigations demonstrates that a carefully-calculated campaign of political terrorism is being waged against medical societies which have opposed the government's program of socialized medicine.

"There can no longer be any pretense," the Board's statement added, "that it is simply a coincidence all of these medical groups have been brought under investigation in a period of a few weeks. This is a politically-inspired attack on those who differ with an Administration-sponsored program and public protest already is mounting in every section of the country against this vicious misuse of the police powers of the Government."

(*continued on page 38*)

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Outside the Ivory Tower

(*continued from page 36*)

THE first industrial hygiene field station west of the Mississippi is being set up in Salt Lake City, Utah, and will soon be ready to give engineering and laboratory help to Western States for aiding manufacturers to better their plant working environments, Dr. Leonard A. Scheele, Surgeon General of the Public Health Service, Federal Security Agency, announced recently. The immediate job of the new field station as soon as it goes into full operation will be to make available to state industrial hygiene agencies an analysis of the atmospheric contaminants of the various working environments in the West. The new field station will be located in the geographic center of the area it is to serve. Housing of its laboratories at the University of Utah, on the outskirts of Salt Lake City, will make it possible for graduate students in industrial hygiene research to use the field station's laboratories and allow the station's staff members to assist the university in presenting industrial hygiene subjects to graduate and undergraduate students.

CROWN Publishers have scheduled for August 22nd publication a book of intense current interest, "Group Medicine and Health Insurance in Action." It is by two doctors and a lawyer, Robert E. Rothenberg, M.D., Karl Pickard, M.D., assisted by Joel Rothenberg, J.D. Dr. George Baehr has written the foreword. "Group Medicine and Health Insurance" reports the experience of a group of doctors who have served over 14,000 people under a comprehensive health plan for two years. The book takes the subject out of the realm of arguable theory and states firmly the result of practice. This is not a national health program nor is it based on compulsory insurance; it is voluntary and it works. "Group Medicine and Health Insurance in Action" tells how to form such groups, the legal and financial aspects of organization, how to operate a group successfully and the problems to be met.

ANOTHER time-tested book is "The Principles and Practice of Rectal Surgery" by William B. Gabriel, M.S. (Lond.). This work was first published in 1932 and has gone through three editions. In this, the fourth edition, a careful revision of the text has been made, a new chapter on anal incontinence is offered, and the chapters on malignant disease have been brought up-to-date. The book covers 508 pages, has four colored plates and 278 illustrations, some in color. Ample references are listed at the end of each chapter and there is a good index. Charles C. Thomas is the publisher and the book may be purchased at a cost of $14.50. Any book that reaches four editions and has been reprinted needs no praise. This is a work of the highest scientific order.

WHILE reading Monica Baldwin's "I Leap Over the Wall," the following lines made us pause and think: "I was once told that destructive criticism never got anybody anywhere. If you permit yourself the luxury of finding fault, you should suggest a remedy."

WE were explaining the reason for American Boards to an engineer, a gentleman of national reputation, and, showing surprise, he said, "Why doesn't someone tell all this to the American public? The public should realize that today a physician does not awaken in the morning and without reason call himself a specialist. He becomes certified in a specialty by going through a long course of hospital training, followed with a number of years of hospital work and then successfully passing written and oral examinations. Publicity would raise the stature of a specialist in the public eye and the public, in turn, knowing how to select a physician competent in a given field, would be safeguarded." We hear that a monthly magazine of wide circulation will publish such an article in the near future. We hope this will prove more than a rumor.

ARTHUR JACOBSON, Editor of *Medical Times*, a good friend and wise man, to our way of thinking, writes the kind of editorials that stick in one's mind. As an example we give you the following: "Warren P. Dearing, representing Federal health authorities, warns that 'essential health services may be endangered if the medical profession does not rid itself of unwarranted fear of governmental action.' Speaking before the New York Academy of Medicine on January 6, 1950, he said that this fear must be 'replaced by cooperative action with representatives of local, state and national governments.'

"This reminds us of the old melodrama in which the villain, after unmerciful battering of the heroine, plaintively asked: 'Why do you fear me, Nellie?'"

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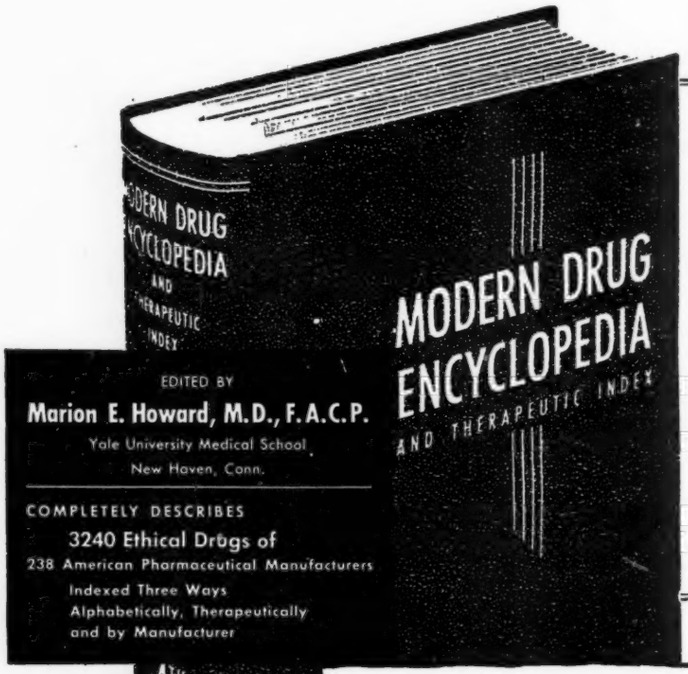

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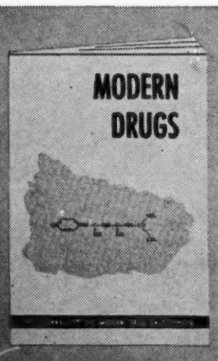

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1. Watts & Ruthberg: Ann. Int. Med., 29:1104, Dec. 1948
2. Henderson, V. E.: Canad. M. A. J., 35:636-637, 1936
3. Gunther, Lewis: U. S. Nav. Med. Bull., 44:300, 1945

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